



D 1.6. Inventory and analysis of national visions/strategy papers



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Abstract:	This review analyses 31 national vision papers from European countries to assess their approach to livestock farming and their alignment with the EU-wide and international sustainability frameworks, such as the EU Farm to Fork Strategy and IPCC guidelines. The assessment focuses on five impact categories of livestock: human nutrition and public health, greenhouse gas and ammonia emissions, antimicrobial resistance, animal health and welfare, and biodiversity. The study reveals a general trend toward promoting sustainable and circular livestock systems, although significant disparities exist in policy depth, implementation capacity, and integration across sectors. Common priorities include reducing emissions through improved manure and feed management, improving animal welfare through legal and ethical standards, addressing antimicrobial resistance through the One Health approach, and improving biodiversity through pasture-based systems and agroecological practices. However, gaps remain in the integration of measures across impact categories, monitoring, financial support of farmers and clear strategies that lead to tangible results. The findings support future policymaking and provide a foundation for working on a sustainable transformation of livestock systems in Europe.

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List of Abbreviations and Acronyms	
Name	Meaning
AMR	Antimicrobial resistance
DART	German Antimicrobial Resistance Strategy
EEA	European Environment Agency
EU	European union
FAO	Food and Agriculture Organisation of the United Nations
GHG	Green hous gas
IPCC	Intergovernmental Panel on Climate Change
NDC	Nationally Determined Contribution
NEC	National Emission reduction Commitments
NMVOCS	Non-Methane Volatile Organic Compounds
NH ₃	Ammonia
NOx	Nitrogen Oxides
PM _{2.5}	Particulate Matter ≤ 2.5 micrometers in diameter
SDGs	Sustainable Development Goals
SO ₂	Sulfur Dioxide
WHO	World Health Organization
WOAH	World Organisation for Animal Health
UNFCCC	United Nations Framework Convention on Climate Change

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1. Introduction

Given the globally growing human population with increasing income, the demand for food of animal origin is expected to increase globally by 38% between 2020 to 2050 [1]. In 2017, the total value of livestock production and livestock products in the EU-28 amounted to €170 billion, accounting for 40% of the total agricultural activity [2]. Dairy and beef cattle farms represents more than 50% of total European herd followed by pig herds (25%) and poultry (15%) [3]. The increase in demand leads to a higher number of animals and more intensive production [4]. While technical progress effectively boosted production, modern livestock production systems and increased consumption also raise environmental, ethical, and public health concerns.

There has been an increasing number of livestock head, and yet the number of livestock farms are decreasing. Between 2005 and 2016, the number of livestock farms was reduced to 3.4 million. This reflects a trend towards intensification [5]. European agricultural authorities are actively shaping the future of livestock production by implementing innovative practices, promoting sustainability, and ensuring high standards of animal welfare and environmental protection. The European Commission [6] suggested that negative impact of the livestock farming on environment and biodiversity must be reduced. According to the European Commission [6], livestock systems should provide a range of goods and services rather than being guided solely by the goal of commodity production.

The environmental footprint of livestock farming worldwide, especially in terms of GHG emission, is significantly increasing and has been a major challenge to the pursuit of a sustainable agriculture globally. Among all the emission sources, enteric methane and manure management are the main contributors [7], together accounting for approximately 50% of total GHG emissions from livestock systems¹. Recent technologies such as precision agriculture, novel feed additives, and manure management can optimize feed utilization efficiency to reduce enteric methane emission, and improve manure storage technologies to mitigate emission of GHG and ammonia. However, policy interventions and incentives are also important to promote regulations and guidelines to improve sustainability in livestock farming [7]. In this regards, to achieve the climate neutrality by 2050, European Union (EU) countries are implementing the European Green Deal strategy. This strategy is a package of policy initiatives, which aims to set the EU on the path of green transition and final goal of carbon neutrality by 2050. One of the legislative instruments supporting the zero pollution ambition to achieve toxin-free environments, as announced in the European Green Deal, is the EU Strategy for Sustainability, which aims to better protect citizens and the environment from harmful pollutants. The National Emission reduction Commitments (NEC) Directive sets commitments for each country to reduce emissions of pollutants, which have significant impact on human health and the environment, including NO_x, NMVOCs, NH₃, SO₂ and PM_{2.5}. The core component of the European Green Deal is the Farm to Fork strategy, which focuses on creating a sustainable food system. This strategy was launched in 2020 and outlines how Europe can produce food in a more sustainable manner, ensuring food security, reducing environmental footprints and improving public health.

Each EU country typically develops vision papers or strategies as part of their national environmental, climate, and sustainability policies. These papers outline long-term goals, commitments, and specific actions aimed at addressing issues such as climate change, emissions reduction, biodiversity preservation, and sustainable development, which reflect their unique priorities and contributions to EU-wide objectives. The objectives of this review are to a) elaborate, how the strategies deal with 5 major impact categories of livestock, b) compare it among countries c) compare it with international strategies.

¹ FAO. 2023. Pathways towards lower emissions – A global assessment of the greenhouse gas emissions and mitigation options from livestock agrifood systems. Rome <https://doi.org/10.4060/cc9029en>

2. Materials and methods

This review was conducted following the methodological framework for scoping reviews outlined by Tricco et al. (2018) and the PRISMA-ScR guidelines. The objective was to map national and international vision or strategy papers on the future of livestock farming, identify their thematic priorities, and compare trends across European countries.

2.1 National vision papers

We included official vision or strategy documents that describe national-level approaches to livestock or agriculture with a livestock component. Where no livestock-specific strategy was available, we included general agricultural strategy documents that referenced livestock farming. Only documents presenting a forward-looking vision or strategic orientation were considered. Documents needed to be accessible in a European language; those not in English were translated using DeepL. For this literature review study, the European national documents were reviewed from different countries including: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Latvia, Luxembourg, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom. Documents were sourced via official national portals, ministries of agriculture, and expert input from the STEP UP project partners. Selection of source documents was screened for relevance based on title and content. Those meeting the eligibility criteria were included for thematic analysis. All selected documents presented a strategic vision of future livestock production, irrespective of animal species or production system. Annex 1 lists the national vision papers used in this analysis.

2.2 Impact categories

The selected national papers were analysed using a thematic analysis approach. Five key thematic categories were predefined through discussions within the STEP UP consortium. These categories reflect priority impact areas in livestock systems:

1. Human nutrition and public health: This impact category aims to address the intricate connections between agricultural practices, food production, and the health outcomes of populations. It evaluates the vision papers regarding the necessity for sustainable, nutritious, and accessible food systems that promote public health and well-being.

2. GHG and ammonia emissions: This impact category focuses on identifying, evaluating, and implementing strategies of the national European countries to reduce the emissions of GHGs. The ammonia emissions impact category focuses on identifying, evaluating, and implementing strategies to reduce ammonia emissions from agricultural practices, particularly livestock production and fertiliser application. This category reviews the visions, which address these challenges by promoting sustainable agricultural practices and improving regulatory frameworks across European countries.

3. Antimicrobial resistance: This impact category refers to the challenge posed by resistant bacteria, which is linked to the overuse and misuse of antibiotics in both human and veterinary medicine. This category aims to evaluate and implement strategies to reduce antimicrobial resistance within the agricultural sector, especially focusing on livestock production.

4. Animal health and welfare: This impact category focuses on the well-being of livestock through sustainable and humane practices. This category aims to promote the physical and mental health of animals, improve living conditions, and ensure ethical treatment throughout their lifecycle. It addresses the welfare needs of animals, which are crucial for ethical, economic, and environmental reasons.

5. Biodiversity: This impact category covers different aspects of biodiversity linked to livestock farming, including local livestock breeds, grassland maintenance, and diversity of crop rotations, soil health, eutrophication, global warming and Rainforest vs. Animal feed production. In the context of agriculture, this category focuses on understanding and mitigating the effects of agricultural practices on biodiversity. The aim is to promote farming systems that support diverse ecosystems and protect wildlife, while balancing productivity with environmental conservation.

2.3 Thematic sub-categories ('subtopics')

To manage the diversity of visions found within each thematic area, a second layer of qualitative content analysis was applied to categorise vision statements into subtopics. Using an inductive coding approach, we reviewed the related visions across all countries.

Across all five impact categories, recurring visions were identified through qualitative review and inductive coding. These were then grouped into thematic subtopics that captured common strategic directions or interventions, enabling systematic cross-country comparison. These subtopics emerged from the data and were refined through iterative discussion to ensure consistency and analytical utility. The presence or absence of subtopics was coded for each country and visualised using heatmaps to detect patterns and priorities across countries. This structured categorisation also enabled us to perform further statistical analysis for both matrix-based comparison (heatmaps) and statistical clustering (e.g., PCA and K-means) across countries.

2.4 International strategies

The national vision papers were compared with selected international strategy papers to identify commonalities and divergences in framing future livestock systems. These international documents included:

- EU Farm to Fork Strategy²
- EU One Health Strategy³
- FAO Livestock Strategies⁴
- IPCC Reports on Agriculture and Land Use⁵

This comparison enabled an understanding of how national strategies align with or diverge from broader European and global policy directions.

2.5 Livestock species

The national and international documents reviewed generally refer to livestock farming in general, without specifying individual species. Therefore, the impact categories were not specified for a specific

² European Commission (2020). Farm to Fork Strategy: For a fair, healthy and environmentally-friendly food system. Brussels.

³ European Commission (2017). EU One Health Action Plan against Antimicrobial Resistance (AMR).

⁴ FAO (2021). Sustainable Livestock 2030: Pathways for transformation. Food and Agriculture Organization of the United Nations.

⁵ IPCC (2019). Climate Change and Land: An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.

livestock category. However, where species are mentioned, they typically refer to cattle, pigs, poultry, and small ruminants. Non-farming animal types, such as companion or leisure animals, are outside the scope of this review, in line with the objectives of the STEP UP project.

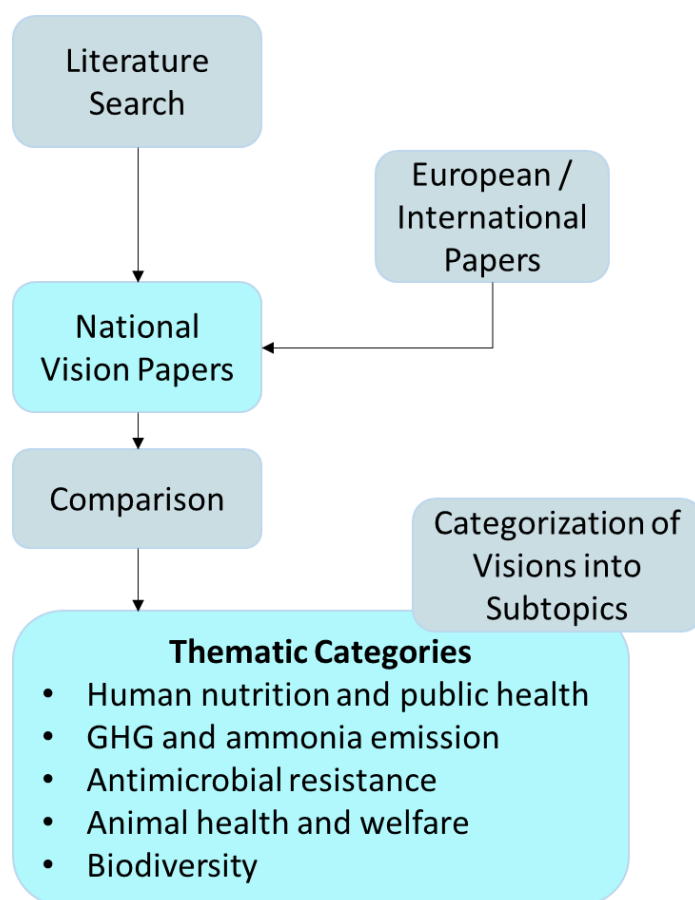


Figure 1. Methodological framework for reviewing future livestock visions in Europe

Some documents were supplied in non-English languages; therefore, DeepL was used to translate them into English. Figure 1 shows the workflow for review and thematic analysis of livestock vision papers.

2.6 Statistics

To explore patterns in the inclusion of vision subtopics across European countries, we applied unsupervised learning and visualisation techniques to binary-coded datasets. Each dataset represented one thematic area (human nutrition and public health, GHG emissions, antimicrobial resistance, animal welfare, and biodiversity), where rows corresponded to countries and columns to specific subtopics, coded as 1 (mentioned) or 0 (not mentioned). Principal Component Analysis (PCA) was used to reduce the dimensionality of each dataset and summarise variation in subtopic coverage among countries. PCA was conducted on centred and scaled data using the `prcomp()` function in RStudio (Version 4.5.0, <https://www.R-project.org>). The first two principal components were retained for interpretation, and a scree plot was used to assess the proportion of variance explained by each component. PCA, as an unsupervised machine learning method, allowed for exploratory analysis without requiring predefined labels or target variables. To visualise the relationships between countries and subtopics in reduced space, a

PCA biplot was generated using the `factoextra` package, RStudio. This two-dimensional plot displayed both individual countries (as points) and subtopics (as arrows), enabling interpretation of how countries aligned with specific policy themes.

As a complementary visualisation, a heat map was created to display the binary presence of subtopics by country, using the `pheatmap` package in R. This allowed for a direct, matrix-style comparison of which countries mentioned which vision components. Clustering of rows (countries) and columns (subtopics) was applied using hierarchical clustering, and colour gradients were used to visually distinguish presence (1) from absence (0).

3. Results

3.1. Human nutrition and public health

This impact category evaluates the current vision of European countries regarding the different aspects of human nutrition and public health. According to Figure 2, the visions of EU countries regarding public health are clustered into seven key categories: sustainability, healthy eating, climate-friendly food, food security, disease prevention, obesity, and public awareness. Figure 3 shows that healthy eating is the most commonly mentioned vision across EU countries, followed by obesity, sustainability, public awareness, disease prevention, climate-friendly food, and food security. Our results indicate that the vision of healthy eating is prominently featured in most EU countries, such as Germany, Denmark, Norway, Austria, and the Netherlands. However, countries like Romania, Serbia, Poland, and Hungary do not mention healthy eating in their vision papers. Overall, the visions of EU countries suggest a general trend toward promoting healthy and sustainable food systems to improve human health. In countries where sustainability and healthy eating are not emphasised, the focus tends to be on obesity prevention and broader public health concerns.

While many European countries share common goals within transnational frameworks like those of the EU, such as reducing obesity, promoting healthy diets, the implementation plans for these goals vary significantly. Implementation in this context refers to the development and enforcement of national policies, resource allocation, public health campaigns and monitoring systems. Some countries like Germany and France tend to have more robust systems in place, supported by comprehensive policies and regulations (e.g., PNNS in France, Nutri-Score and BZfE in Germany), while other European countries are still working to close gaps in health inequalities, food accessibility, and policy enforcement. Several countries are aligning with EU policies but face unique challenges in integrating comprehensive nutrition and physical activity strategies. The EU Farm to Fork Strategy and other EU-wide frameworks provide a common direction, but local contexts and capacities shape how these policies are executed across different regions.

Inventory and analysis of vision papers concerned with livestock

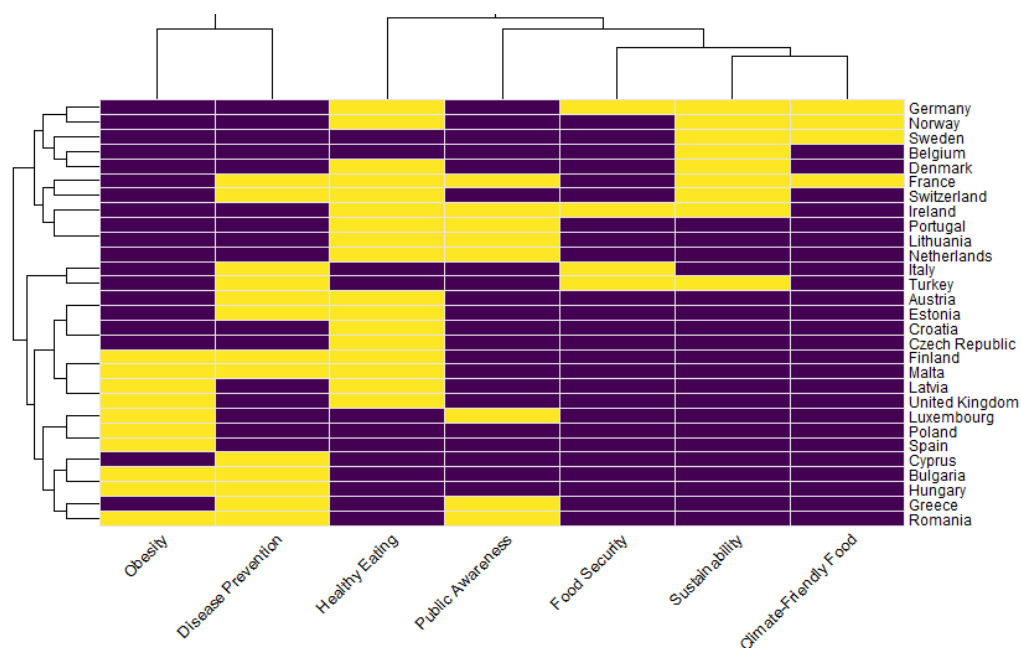


Figure 2. Human nutrition and public health-related subtopics, mentioned in national vision papers concerned with livestock⁶. Purple: subtopic mentioned; yellow: not mentioned.

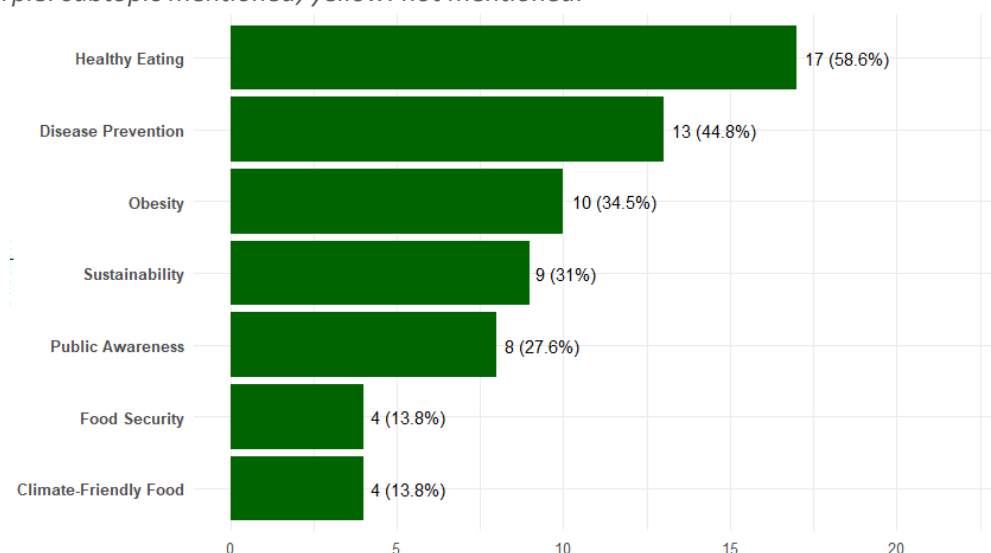


Figure 3. Prevalence of human nutrition and public health subtopics across countries. Number and percentage of countries mentioning each subtopic².

⁶ Each national vision paper was scanned for statements related to Human nutrition and public health. The statements were categorised into seven harmonised subtopics: **1: Sustainability** includes visions that balances environmental health, economic viability, and social equity across livestock farming and food production; **2: Healthy eating** includes visions which promote healthier diets such as reduce overconsumption of red and processed meat, promote balanced diets, alternative proteins etc; **3: Climate friendly food** includes visions to promote consumption of food with low emission, less food waste etc; **4: Food security** includes visions including not just food availability but also affordability, accessibility, and nutrition; **5: Disease prevention** addresses human health risks linked to the consumption of livestock-origin foods, especially in terms of foodborne illnesses, diet-related diseases etc; **6: Obesity prevention** is connected with visions such as healthy diets, sustainable food production, and consumer behavior change; **7: Public awareness** vision integrates multiple dimensions-from food safety to nutrition, environmental impacts, and disease prevention-to promote healthier populations. All data for human nutrition and public health visions are available in Annex 2.

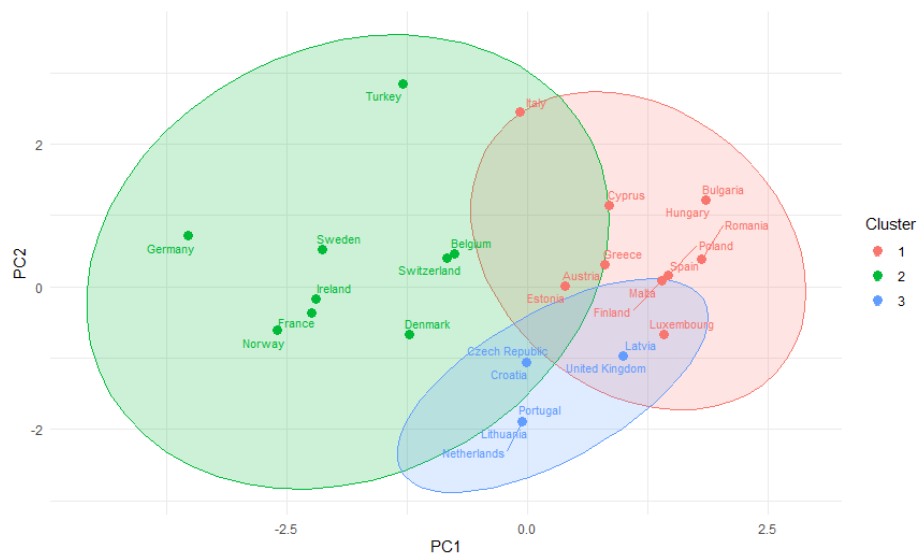


Figure 4. PCA clustering of countries by human nutrition and public health subtopics

To identify patterns in how countries cluster based on their public health visions, K-means clustering ($k = 3$) was applied to the PCA-reduced data (Figure 4). Cluster 1 included countries such as Bulgaria, Romania, Hungary, Poland, Greece, Turkey, Slovenia, Switzerland, Netherlands, Italy, Ireland, Belgium, and Spain. These countries were characterised by broad coverage of subtopics, including healthy eating, food security, public awareness, and GHG mitigation, reflecting a relatively holistic vision for public health in food systems. The cluster spans mostly Eastern Europe, suggesting convergence in vision development. Cluster 2 included countries such as Germany, Denmark, France, Austria, and Sweden, with a narrower focus primarily on GHG reduction and energy-related public health risks, but relatively less emphasis on food-related health concerns. These countries represent mostly Western/Northern Europe, indicating a more technical or sector-specific framing of public health. Cluster 3 comprised countries such as Czech Republic, Slovakia, and Croatia, which had the lowest subtopic engagement overall. These countries showed limited attention across most public health visions, which may reflect a less developed vision in terms of human health. All three are located in Eastern Europe, hinting at regional disparities in vision development and documentation.

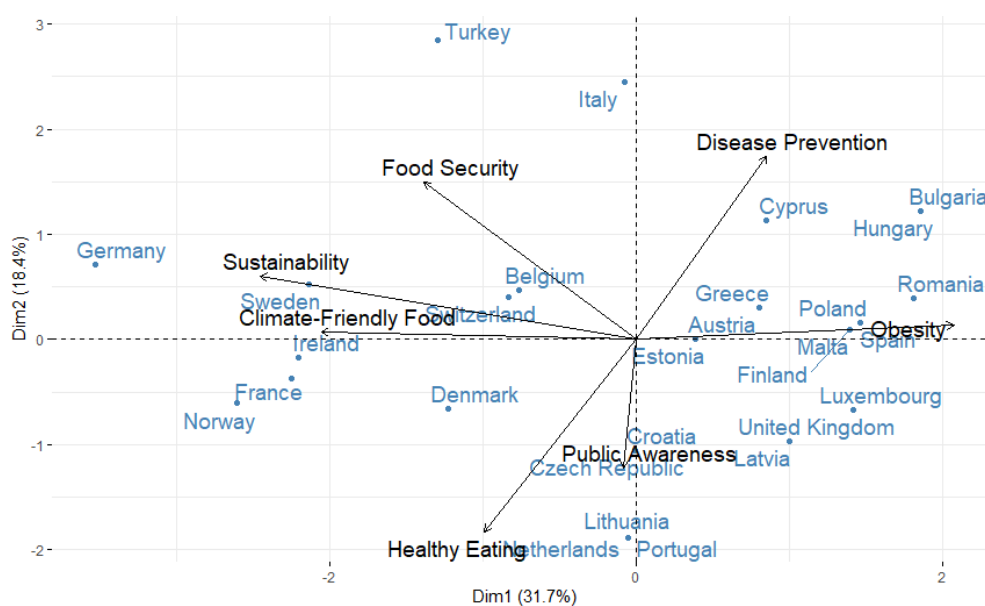


Figure 5. PCA Biplot of countries by public health vision subtopics.

A PCA was conducted on binary-coded public health vision subtopics from national documents of European countries. The first two principal components explained 48.7% of the total variance (PC1: 29.3%, PC2: 19.4%). The resulting biplot (Figure 5) reveals how individual countries align with specific public health subtopics, and how those subtopics contribute to the overall variance. For example, countries such as Ireland, Italy, and Slovenia are located closer to vectors representing healthy eating, public awareness, and food security, suggesting broader and more integrated vision statements. In contrast, countries like Czech Republic and Slovakia appear less aligned with the subtopics, indicating either more limited vision coverage or a more targeted focus on select priorities. Countries positioned near the origin, such as Germany or France, tend to reflect more balanced or moderate attention across the range of subtopics, without strong alignment to any single vision. The direction and length of the subtopic vectors (e.g., "obesity prevention" and "antimicrobial resistance") further indicate the relative importance and variation of those themes across countries.

3.2. Greenhouse gas and ammonia emissions

Figure 6 shows how GHG and ammonia emissions are mentioned across European countries in livestock strategies. The visions of the European countries were clustered into 7 categories, including: livestock and feed management, fertiliser and manure management, breeding and genetics, methane and GHG emission, sustainable practices and carbon sequestration, circular economy, innovation and technology. For example, Turkey, Ireland, and the Netherlands placed strong emphasis on manure and methane-related strategies, while countries such as Lithuania, France, and Estonia focused more on sustainable practices and carbon sequestration. Figure 7 presents the most frequently mentioned themes in the EU countries. To further explore regional similarities, countries were grouped based on their subtopic coverage.

Several European countries have incorporated fertiliser and manure management as key strategies to reduce greenhouse gas and ammonia emissions in the agriculture sector. Common approaches include optimising fertiliser use through precision farming, improving manure storage and processing, and integrating nutrient efficiency into feed and farming systems. For example, Germany and Ireland focus on optimising fertiliser application, with Ireland targeting a more than 50% reduction in nitrous oxide emissions from chemical fertilisers by 2030. Denmark, Austria, and Finland promote improved manure management and nutrient efficiency, including the use of slow-release fertilisers. Countries like Bulgaria, Lithuania, and Estonia emphasise low-emission manure storage and the replacement of mineral fertilisers with organic alternatives. France and Portugal link precise manure and fertiliser management to broader efforts in reducing ammonia emissions, while Turkey and Poland support the use of manure in biogas production. Romania also aims to reduce fertiliser-related emissions and utilise manure methane for energy. These measures are often supported by technological innovation, financial incentives, and a broader shift toward sustainable, circular farming practices.

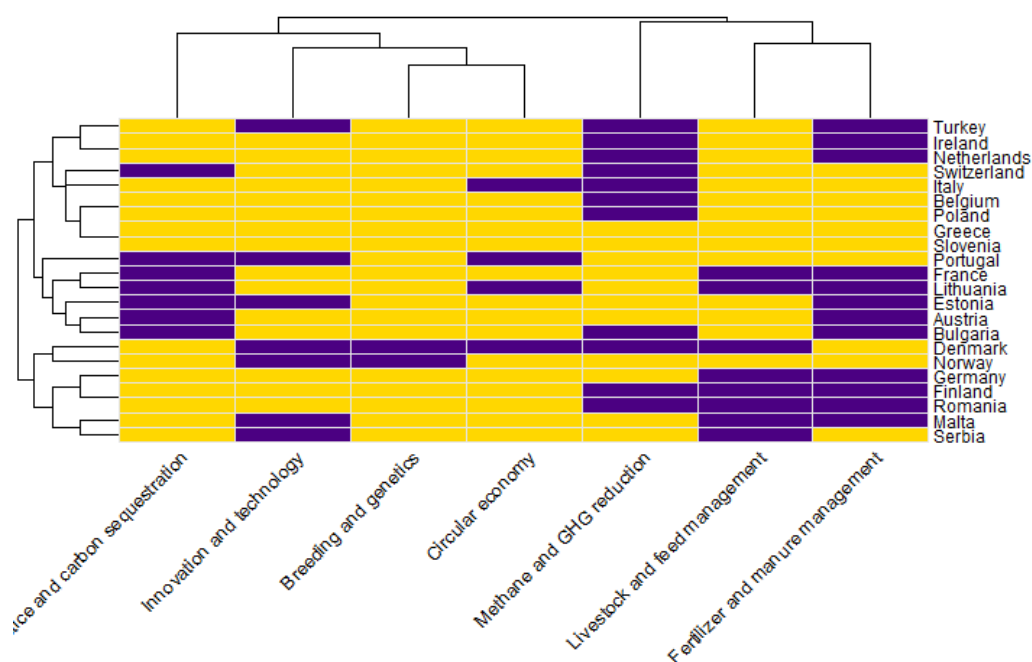


Figure 6. GHG and ammonia emission visions across European countries in livestock strategies⁷. Purple: subtopic mentioned; yellow: not mentioned.

⁷ Each national vision paper was scanned for statements related to GHG and ammonia. The statements were categorized into seven harmonized subtopics: **1: Livestock feed and management** includes visions regarding dietary strategies such as using feed additives and improving feed digestibility to reduce enteric methane; **2: Fertilizer and manure management** includes visions to develop and implement integrated fertilizer and manure strategies to reduce GHG and ammonia emission; **3: Breeding and genetics** include visions that leverage genetic selection and advanced breeding technologies to develop low-emission livestock; **4: Methane and GHG reduction** includes all management strategies to reduce emission; **5: Sustainable practice and carbon sequestration** includes visions to improve practices which contribute to climate mitigation by enhancing carbon sequestration through improved grazing management, soil health, and circular nutrient use; **6: Circular economy** includes approaches in livestock systems to promote resource efficiency by recycling nutrients, valorizing waste streams, and reducing environmental impacts; **7: Innovation and technology** includes visions to support low emission livestock farming such as precision feeding, smart manure management, and real-time emission monitoring. All data for GHG and ammonia emission visions are available in Annex 3.

Inventory and analysis of vision papers concerned with livestock

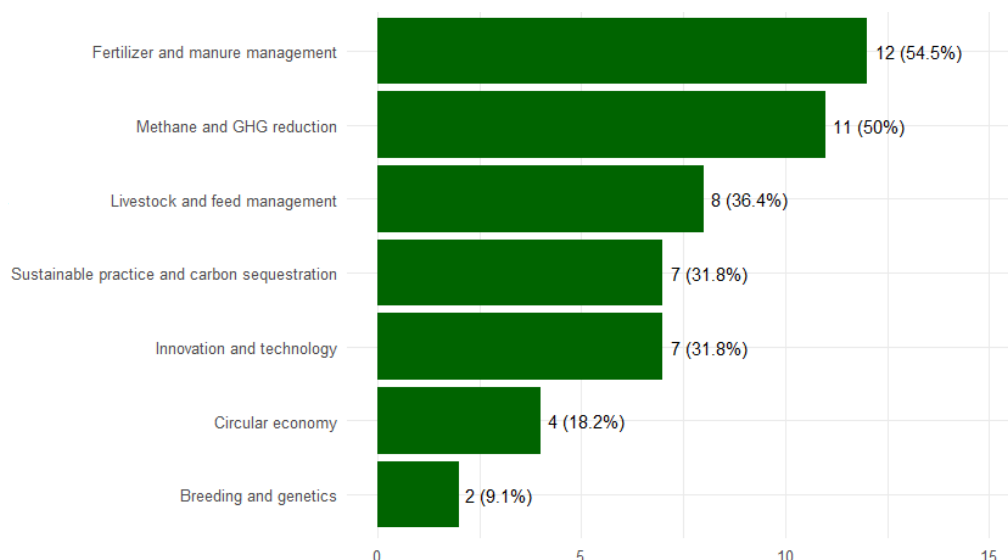


Figure 7. Frequency of GHG emission visions in the EU countries. Number of countries mentioning each vision in national documents³.

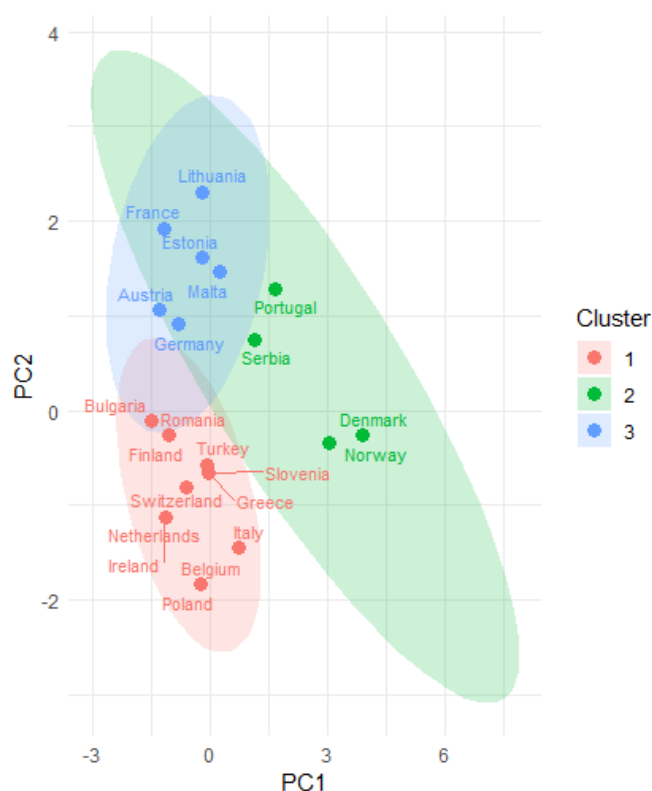


Figure 8. Identification of regional patterns in GHG emission subtopics across countries through PCA and unsupervised clustering.

K-means clustering based on the first two principal components of the GHG emission subtopic data identified three distinct clusters of countries (Figure 8). The clusters reflect similarities in emission-related policy visions or emission profiles, with countries in the same cluster sharing common emphasis or performance on specific subtopics (e.g., mitigation, agriculture, energy). The PCA plot shows a clear separation between clusters, suggesting meaningful groupings in how countries approach or report on GHG-related themes. For example, Cluster 1 includes Bulgaria, Romania, Finland, Turkey, Slovenia, Switzerland, Greece, the Netherlands, Italy, Ireland, Belgium, and Poland, characterised by a relatively broad engagement with multiple GHG emission subtopics, including agricultural emissions, energy-related

Inventory and analysis of vision papers concerned with livestock

emissions, and mitigation strategies. This suggests these countries may be adopting multi-sectoral approaches to GHG reduction, reflecting either more integrated policies or comprehensive reporting practices in their national documents. Cluster 2 comprises countries such as Germany, Denmark, Austria, Sweden, and France, characterised by a strong emphasis on mitigation and renewable energy, with less explicit attention to land-use, biodiversity, or animal-based emissions. This pattern may indicate a policy orientation more aligned with technological and sectoral decarbonization, rather than integrated food and agriculture strategies. Cluster 3 includes Czech Republic, Slovakia, and Croatia, characterised by a relatively narrow or low emphasis on GHG subtopics in their national documents. These countries may prioritise other policy areas (e.g., food security, economic development) or are still in the early stages of integrating comprehensive GHG reduction strategies into their livestock or food policy visions. Countries in Cluster 1 may be leading on integration, while those in Cluster 2 lean toward high-tech mitigation. The third group may benefit from further policy development to match the EU's 2050 climate neutrality goals.

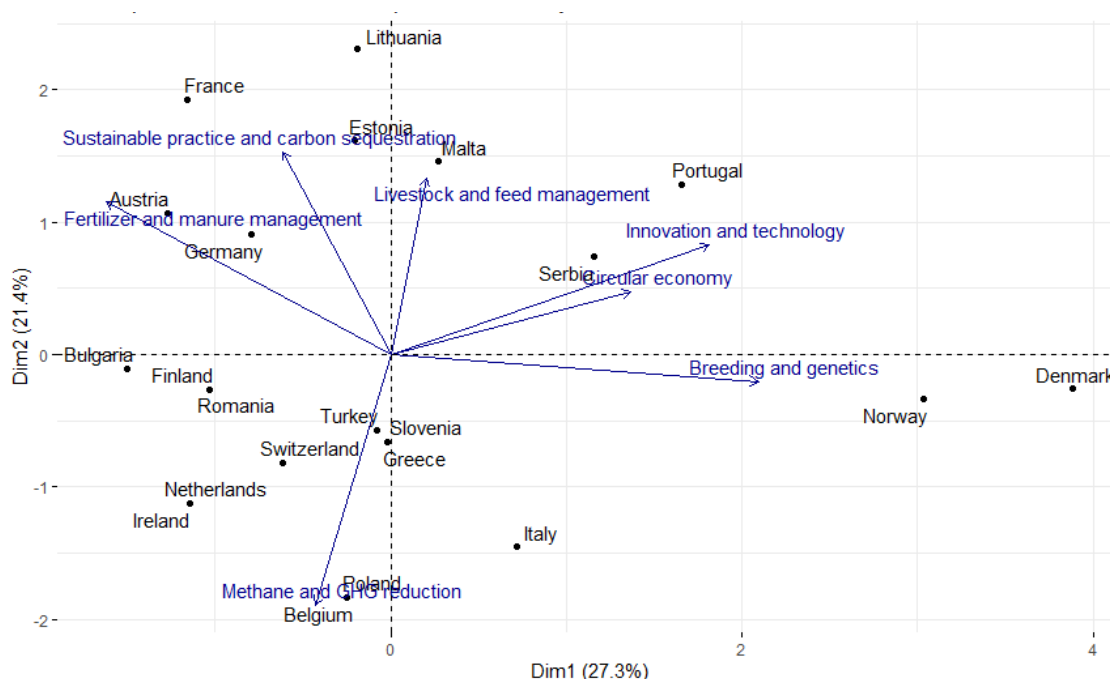


Figure 9. Visualisation of country positioning and variable loadings along the first two principal components derived from GHG emission subtopics.

The results of Figure 9 show how countries group together based on the overall thematic content of their livestock visions. Countries located near specific subtopic vectors (arrows) are more aligned with those thematic areas. For instance, Germany and Austria have a developed vision on the fertiliser and manure management, indicating a stronger emphasis on these approaches. Countries such as Germany, Ireland, and Denmark are positioned closer to the vectors for subtopics such as manure management, fertiliser use, and emission reduction targets, suggesting a stronger presence of these elements in their vision documents. Other countries, such as Romania and Greece, are located near the centre of the biplot, with no clear proximity to specific subtopics. Subtopics like sustainable livestock practices, circularity, and methane mitigation show stronger directional influence in the biplot, based on vector length and orientation.

3.3. Antimicrobial resistance

Figure 10 represents the vision of European countries regarding Antimicrobial resistance (AMR). We have clustered the visions in 7 different categories, namely: responsible/optimised use, monitoring and surveillance, infection prevention/control, research and innovation, public awareness/education, international collaboration, One Health Approach. According to Figure 11, the ‘monitoring and surveillance’ is the most frequently mentioned vision in all countries, followed by responsible/optimised use.

European countries have adopted a range of strategies and goals to address AMR, with notable consistency in focus areas. Most countries emphasise the responsible use of antimicrobials, often supported by national action plans aimed at optimising prescribing practices across sectors. Monitoring and surveillance of antimicrobial use and resistance patterns are central elements in nearly all national strategies, providing the necessary data to guide policy and assess progress. Many countries also prioritise infection prevention and control measures within healthcare and veterinary settings to reduce the need for antimicrobials. Research and innovation are widely promoted, including the development of new antibiotics and alternatives, as well as support for evidence-based policy. Public awareness and education campaigns are emphasised, targeting both professionals and the general public to improve responsible antibiotic use. Several countries highlight international cooperation and alignment with global frameworks, particularly the WHO guidelines. Furthermore, the One Health approach, which integrates human, animal, and environmental health, is adopted in many national strategies, reflecting a growing recognition of the interconnected nature of AMR. Some countries also include quantitative targets for reducing antibiotic consumption and emphasise governance, regulation, and improved diagnostics as part of their comprehensive response to AMR.

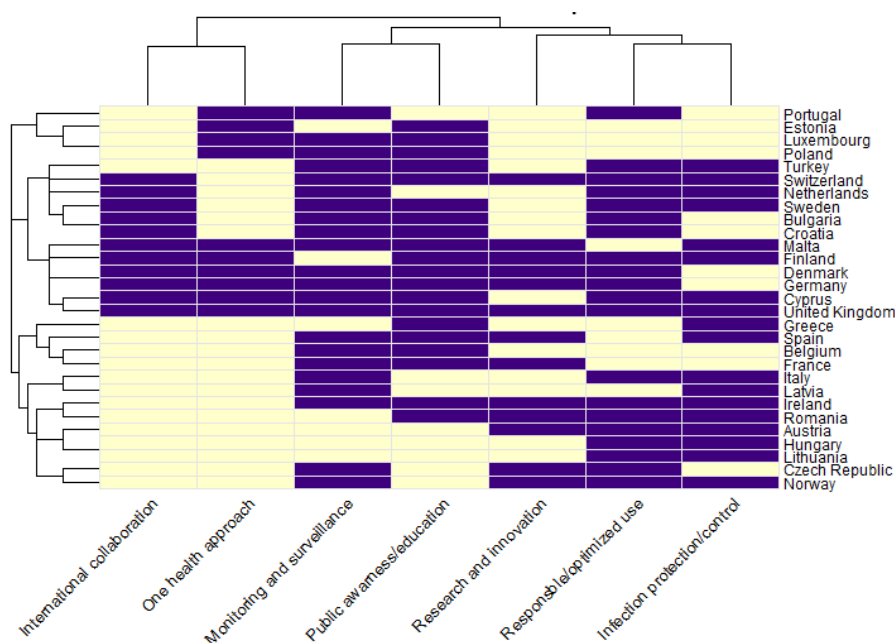


Figure 10. Antimicrobial resistance visions across European countries in livestock strategies⁸. Purple: subtopic mentioned; yellow: not mentioned.

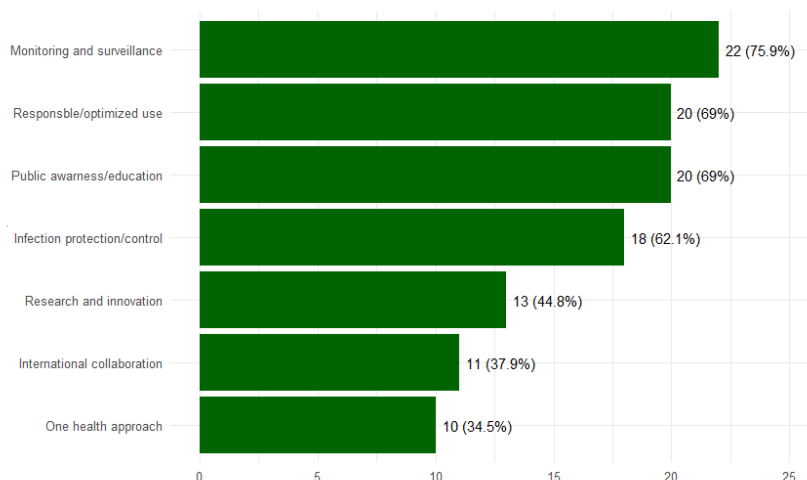


Figure 11. Most common visions of antimicrobial resistance across European countries⁴.

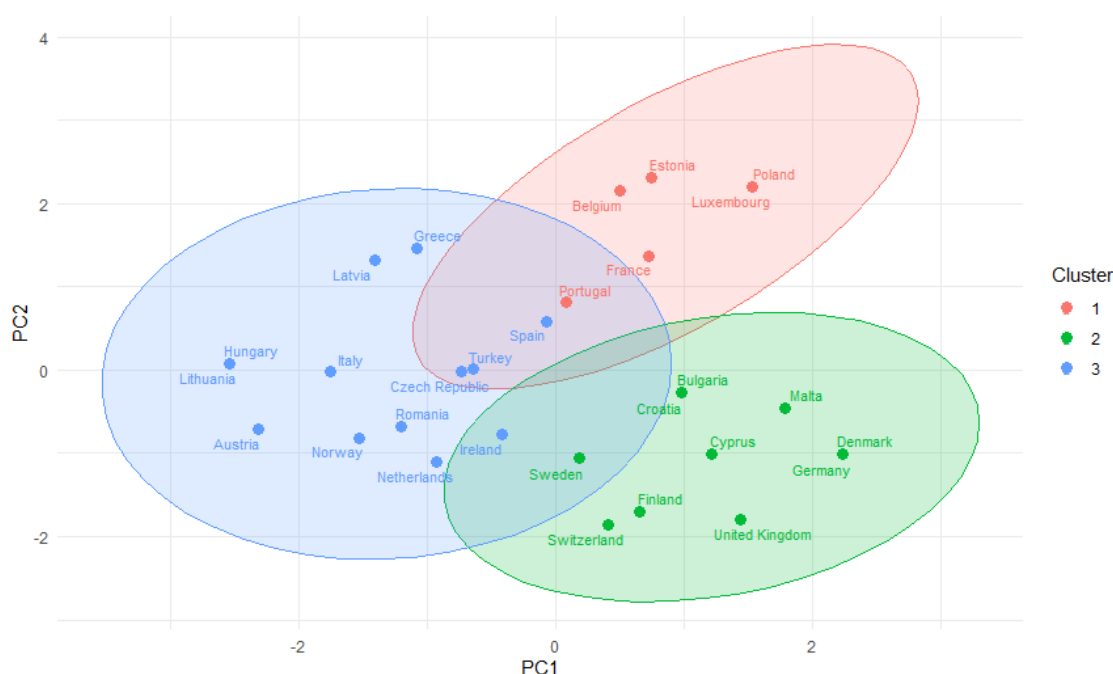


Figure 12. Identification of regional patterns in antimicrobial subtopics across countries through PCA clustering.

⁸ Each national vision paper was scanned for statements related to GHG and ammonia. The statements were categorized into seven harmonized subtopics: **1: responsible/optimized use** refers to strategies promoting targeted, and reduced use of antimicrobials to mitigate antimicrobial resistance while safeguarding animal; **2: monitoring and surveillance** refers to strategies supported by monitoring and surveillance, to mitigate antimicrobial resistance while safeguarding animal and public health; **3: infection prevention/control** refers to antimicrobial use visions, with monitoring, surveillance, and infection prevention/control to combat resistance and protect health; **4: research and innovation** refers to visions supported by monitoring, prevention, and research to address resistance and safeguard health; **5: public awareness/education** includes visions which address public awareness about optimized use of antibiotics; **6: international collaboration** refers to visions targeting the international collaboration to optimize use of antimicrobials; **7: one health approach** refers to visions addressing One Health Approach. All data for antimicrobial resistance visions are available in Annex 4.

Inventory and analysis of vision papers concerned with livestock

Figure 12 displays the clustering of countries based on PCA of AMR subtopics. Countries were grouped according to the similarity of AMR-related visions expressed in their national livestock strategy documents. The analysis revealed distinct clusters of countries with similar emphasis on key subtopics such as monitoring and surveillance, responsible antimicrobial use, infection prevention, and research and innovation. Countries within the same cluster tend to prioritise similar components of AMR management in their national visions. The analysis showed a clear differentiation among countries. Figure 13 further refines this observation by grouping countries into distinct clusters. The biplot analysis reveals distinct patterns in how countries prioritise various visions related to antimicrobial resistance (AMR). Countries such as Germany, Denmark, the United Kingdom, and Cyprus show a strong alignment with visions emphasising international collaboration, the One Health approach, public awareness and education, and monitoring and surveillance. In contrast, Sweden, Switzerland, and Finland are more closely associated with visions focused on research and innovation, as well as international cooperation. A group of countries, including the Netherlands, Norway, Romania, Austria, Italy, and Lithuania, aligns more with strategies that promote responsible or optimised antimicrobial use and infection protection and control. Several countries—such as Latvia, Greece, Czech Republic, Portugal, Spain, Turkey, and Ireland—are positioned near the centre of the plot, indicating a broader or more balanced approach without a strong emphasis on any single vision. Meanwhile, countries like Malta, Bulgaria, Croatia, Luxembourg, Poland, Estonia, Belgium, and France cluster around visions related to One Health, surveillance, and public engagement, reflecting a comprehensive or evolving policy focus in these areas.

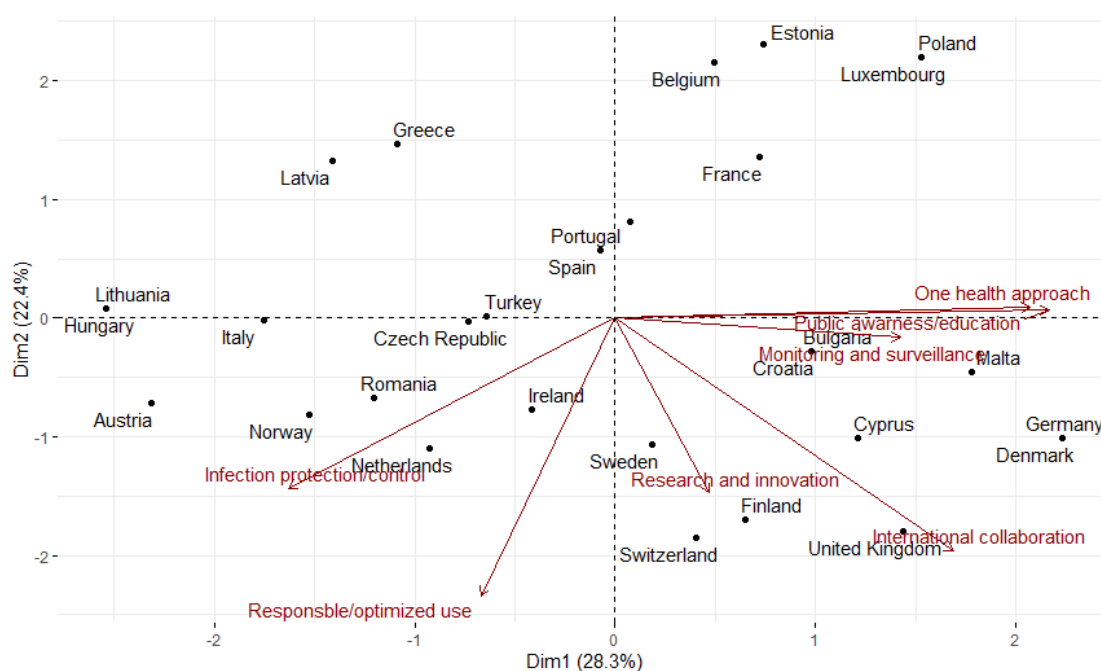


Figure 13. Visualisation of country positioning and variable loadings along the first two principal components derived from antimicrobial subtopics.

3.4. Animal health and welfare

Figure 14 presents the vision of the EU countries for ‘animal health and welfare’. The vision of the countries was clustered in 6 different categories, including: legislation, public awareness, sustainable farming, animal transport, ethical farming/protection, and EU alignment. According to Figure 15,

Inventory and analysis of vision papers concerned with livestock

‘Legislation’ is the most common vision across all the EU countries, followed by public awareness, sustainable farming, animal transport, ethical farming/protection, and EU alignment. European countries demonstrate varied approaches to promoting animal welfare, with most implementing legal frameworks such as national animal welfare acts and aligning policies with EU legislation.

Many countries, such as Germany, Denmark, the Netherlands, and Austria, have established comprehensive laws and strategies addressing animal transport, ethical farming, and housing conditions. Public awareness campaigns, education, and stakeholder engagement are common tools used to support welfare goals. Countries like Switzerland, Norway, and Sweden show strong emphasis on high welfare standards, scientific principles, and ethical considerations (Annex 5). To confirm this results, we compare the resource allocations of Sweden to Germany and found that although Germany invests more in absolute terms (298 million Euro compare to 125 million Euro in Sweden), Sweden allocates a larger share of its rural development funding to clearly defined and targeted animal welfare schemes, making its support more concentrated and impactful relative to its budget size^{9,10,11}. This resource allocation might result in a more prominent animal welfare vision in Sweden.

Several nations also promote international cooperation and policy leadership. In Turkey’s vision paper, there is some progress regarding farm animal health and welfare, but it is still not complete. In addition, no link to animal health and welfare was found in the vision paper of Luxembourg, Malta, and Romania. However, it should be mentioned here that although some countries did not provide a link to animal health and welfare in the vision papers, they have already other national documents which provide national policies of the country. Overall, national efforts increasingly reflect a shift toward a One Health and sustainability-oriented perspective, with growing attention to ethical farming, research, and enforcement mechanisms.

⁹ European Commission (2024a). CAP Strategic Plan – Germany at a glance. Directorate-General for Agriculture and Rural Development. Available at:

https://agriculture.ec.europa.eu/system/files/2024-01/csp-at-a-glance-germany_en.pdf

¹⁰ European Commission (2024b). CAP Strategic Plan – Sweden at a glance. Directorate-General for Agriculture and Rural Development. Available at:

https://agriculture.ec.europa.eu/system/files/2024-01/csp-at-a-glance-sweden_en.pdf

¹¹ Paws International (2025). The GAP in the CAP: Animal Welfare in the EU’s Common Agricultural Policy. Available at:

https://media.4-paws.org/8/c/6/7/8c67fa4117922cd3eee0c8a2cb8b1390aca5bbb6/2025-04_The-GAP-in-the-CAP-report_WEB.pdf

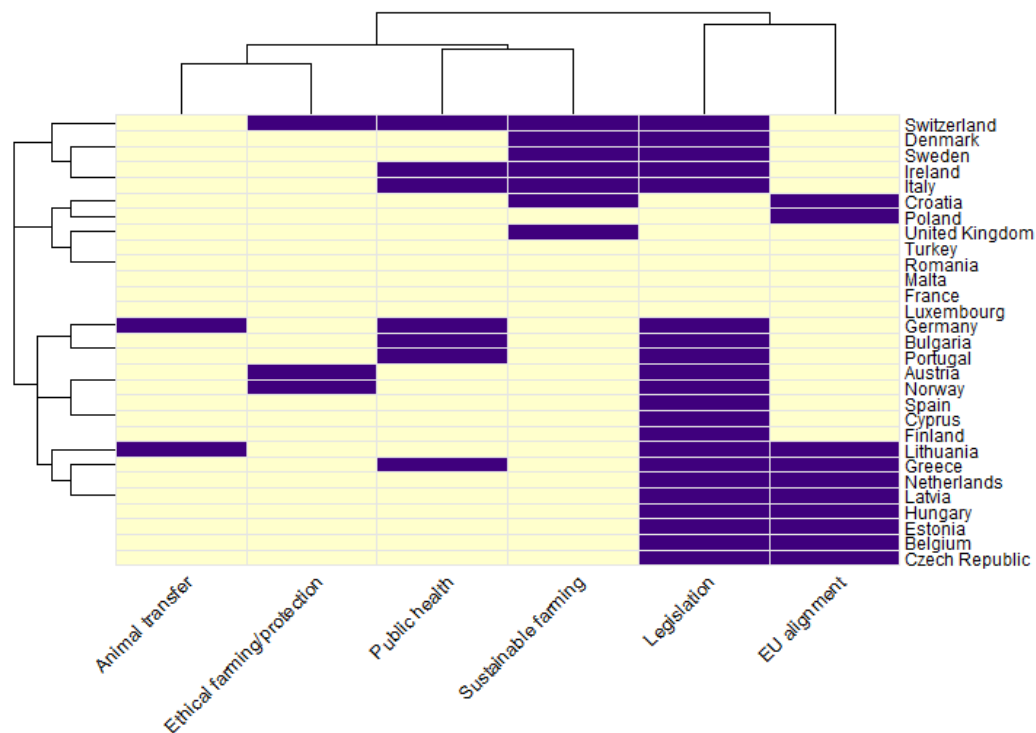


Figure 14. Animal health and welfare visions across European countries in livestock strategies¹². Purple: subtopic mentioned; yellow: not mentioned.

¹² Each national vision paper was scanned for statements related to GHG and ammonia. The statements were categorized into six harmonized subtopics: **1: legislation** refers to legal frameworks ensuring animal health, disease control, and welfare standards; **2: public awareness** refers to efforts to inform and educate stakeholders and the public on animal health and welfare issues; **3: sustainable farming** refers to measures that prevent or control the spread of diseases among animals; **4: animal transport** refers to regulations and practices ensuring animal welfare during transport; **5: ethical farming/protection** refers to practices and policies promoting humane treatment and ethical standards in animal farming; **6: EU alignment** refers to alignment of national policies with EU animal health and welfare standards and regulations. All data for animal health and welfare visions are available in Annex 5.

Inventory and analysis of vision papers concerned with livestock

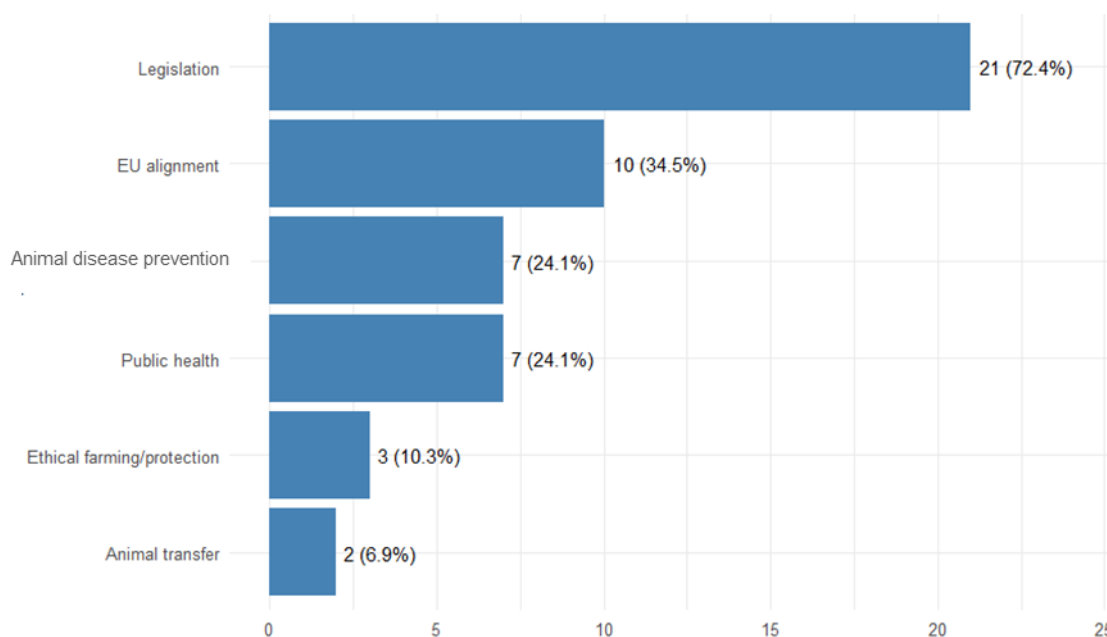


Figure 15. Most common visions of animal health and welfare across European countries⁴.

Figure 16 illustrates the clustering of countries based on their national visions for animal health and welfare using PCA. Three main regional clusters are evident. Cluster 1 (in red), consisting of countries such as Switzerland, Ireland, Italy, Denmark, Austria, Norway, Portugal, and Bulgaria, reflects a group with a strong emphasis on traditional legal frameworks, enforcement measures, and baseline welfare standards. These countries tend to prioritise regulation and infrastructure over broader ethical or sustainability narratives. Cluster 2 (in green) includes Germany, Greece, and Lithuania, which are distinguished by a more systemic and sustainability-oriented approach. Their vision papers show stronger alignment with ethical farming, the One Health approach, and long-term structural reform in animal health and welfare systems. Cluster 3 (in blue), comprising countries like the United Kingdom, Poland, Spain, Finland, and Cyprus, shows a mixed pattern. These countries emphasise a combination of public awareness, EU alignment, and international cooperation, suggesting a balance between domestic policy frameworks and broader regional or global strategies. The clear separation between clusters suggests that while some countries focus heavily on regulatory and institutional approaches, others are moving toward integrated and ethics-based visions for animal welfare.

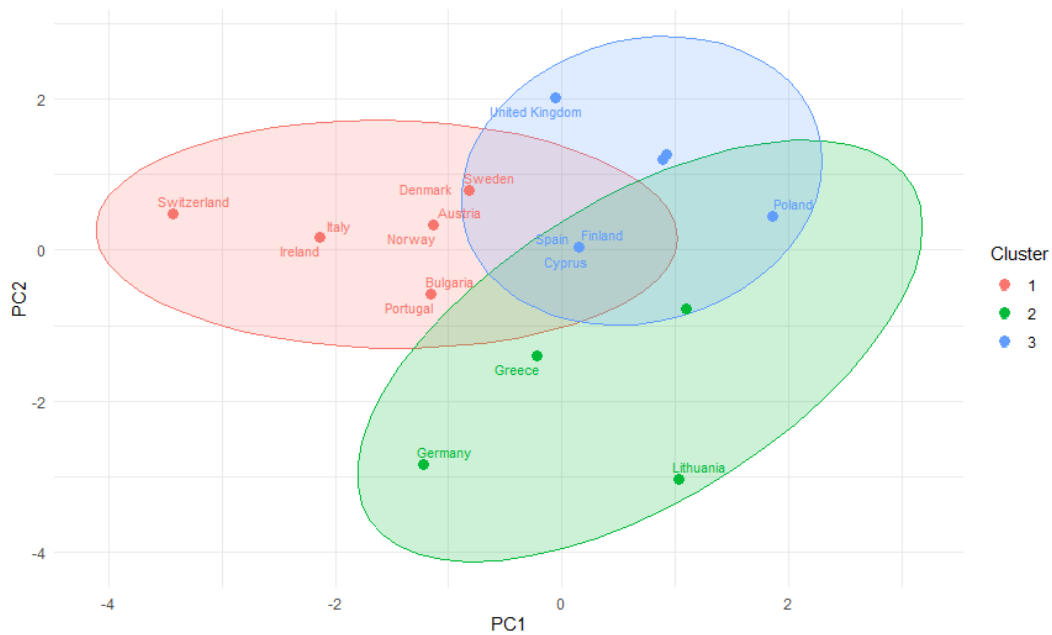


Figure 16. Identification of regional patterns in animal health and welfare subtopics across countries through PCA clustering

Figure 17 presents the PCA biplot showing the positioning of countries in relation to six key animal health and welfare subtopics: legislation, animal transport, ethical farming/protection, public health, sustainable farming, and EU alignment. The first two dimensions explain 50.7% of the total variance. The biplot indicates that Germany is most strongly associated with legislation, suggesting a national vision heavily grounded in regulatory approaches. In contrast, countries like Lithuania, Poland, Czech Republic, and Hungary are positioned in the direction of EU alignment, reflecting a focus on harmonising national strategies with EU standards. Countries such as Sweden, Austria, Denmark, and Norway cluster around ethical farming/protection and sustainable farming, indicating a commitment to welfare-oriented and environmentally sustainable practices. Ireland and Switzerland are similarly aligned, with Switzerland showing a unique positioning far from other countries, possibly due to its strong independent welfare legislation. Meanwhile, France, Malta, Luxembourg, and Croatia show positive associations with EU alignment and monitoring through international frameworks. Southern and Eastern European countries, including Portugal, Bulgaria, and Romania, fall near the origin or in proximity to animal transport and public health, suggesting a broader or less specialised approach. Notably, Greece and Spain occupy central positions in the biplot, possibly indicating more balanced or diffuse strategies across multiple vision categories.

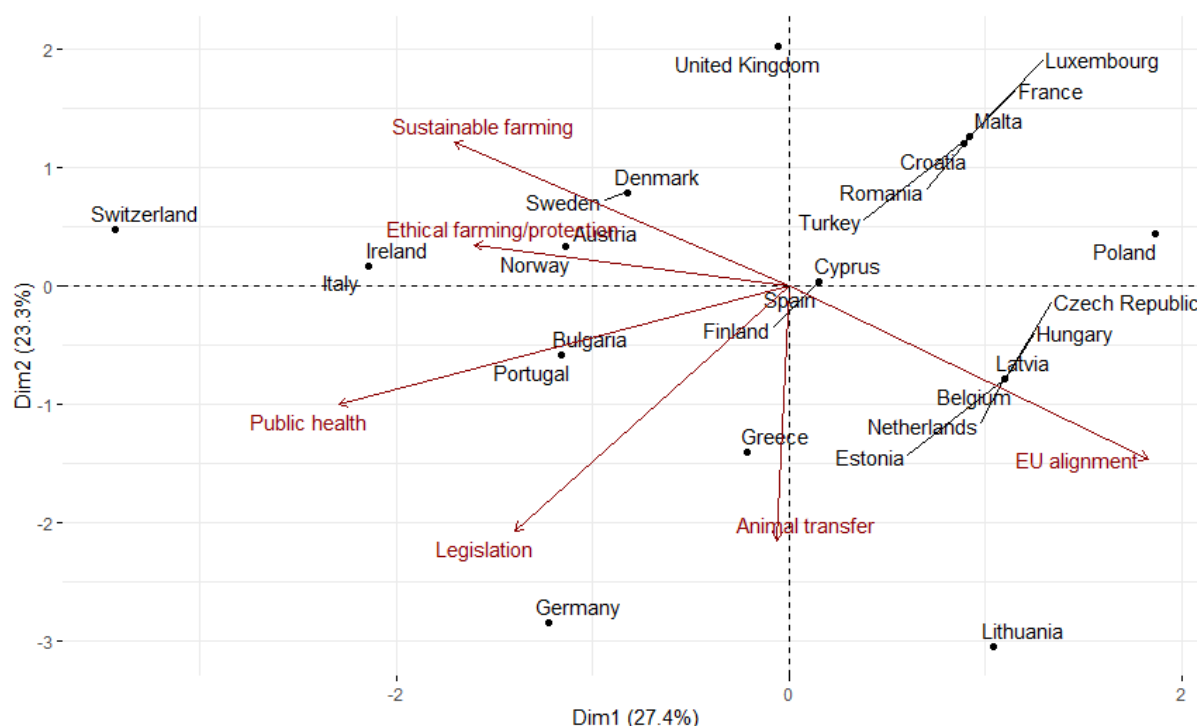


Figure 17. Visualisation of country positioning and variable loadings along the first two principal components derived from animal health and welfare subtopics

3.5. Biodiversity

Figure 18 presents the biodiversity visions across European countries in livestock strategies. The most frequent visions in the vision papers of the European countries include: livestock breed biodiversity, sustainable livestock farming practices, extensive management, which is opposite to intensification of the livestock farming, land use management, climate protection actions, subsidies to farmers and innovation and communication developments across member states and also at the national levels. According to Figure 19, in most of the EU countries, developing sustainable livestock farming is one of the planned strategies to improve biodiversity. In addition, climate protection measures are also suggested for improving biodiversity. It's followed by innovation and cooperation development, land use, breed diversity, extensive management, climate protection, and sustainable farming.

Many countries emphasise the promotion of pasture-based and extensive grazing systems, supporting breeding diversity, and reducing intensive livestock production to enhance ecosystem health (Annex 6). Initiatives such as integration of biodiversity goals into farming practices, preservation of genetic resources, and development of nature-friendly management systems are common themes. Several nations also highlight the importance of supporting farmers through policy and financial incentives, agri-environmental schemes, and rewarding ecosystem services to encourage biodiversity-friendly agriculture (Annex 6). Collaborative efforts involving farmers, researchers, and policymakers aim to align agricultural productivity with conservation goals. Additionally, there is an increasing focus on sustainable land use, organic farming, and reducing environmental pressures from agriculture, including nutrient runoff and greenhouse gas emissions. Overall, the strategies demonstrate a multidimensional approach toward balancing agricultural productivity with biodiversity conservation, reflecting an evolving recognition of the essential role of livestock farming in maintaining ecological integrity.

Inventory and analysis of vision papers concerned with livestock

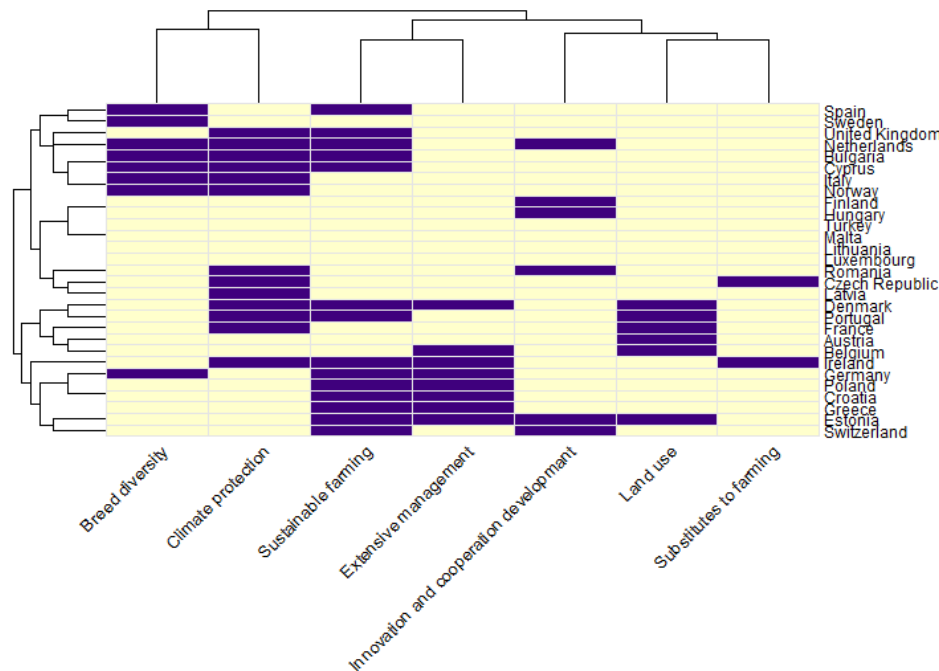


Figure 18. Biodiversity visions across European countries in livestock strategies¹³. Purple: subtopic mentioned; yellow: not mentioned.

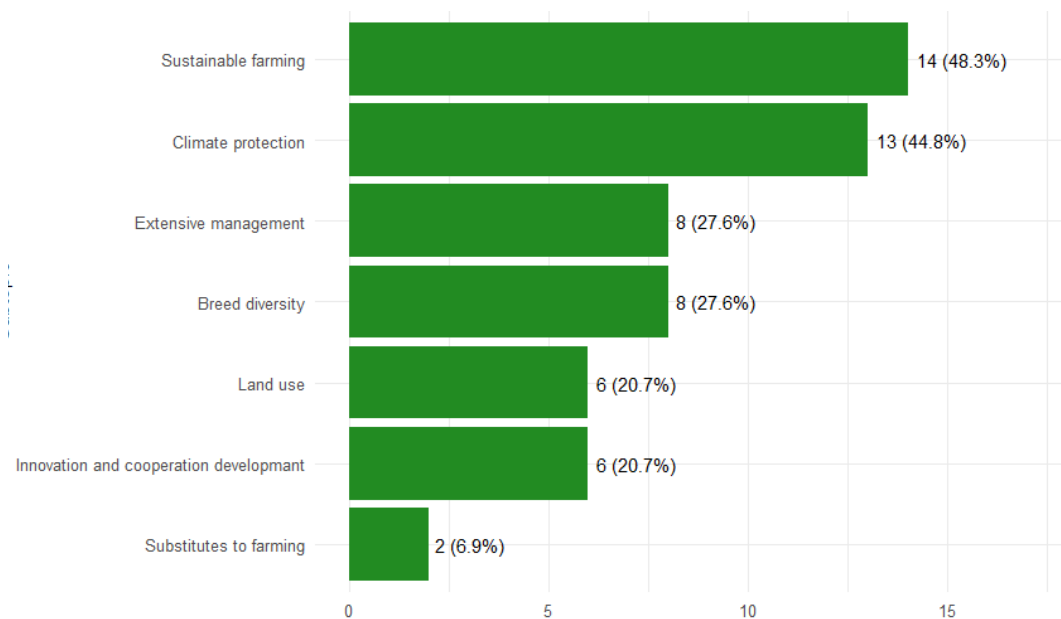


Figure 19. Most common visions of biodiversity across European countries⁵.

¹³ Each national vision paper was scanned for statements related to GHG and ammonia. The statements were categorized into six harmonized subtopics: **1: breeding diversity** refers to the conservation and promotion of diverse animal breeds to support biodiversity and genetic resilience; **2: sustainable farming** refers to agricultural methods that protect natural resources, support biodiversity, and ensure long-term productivity; **3: extensive management** refers to low-intensity farming systems that allow natural behaviors and support biodiversity; **4: land use** refers to managing agricultural landscapes to preserve natural habitats and promote ecological balance; **5: climate protection** refers to practices that reduce greenhouse gas emissions and enhance resilience to climate change; **6: Subsidies to farmers** refers to incentives or support provided to farmers for adopting biodiversity-friendly practices; **7: innovation and cooperation development** refers to improving new ideas, technologies, and partnerships to enhance biodiversity and sustainability efforts. All data for biodiversity visions are available in Annex 6.

Inventory and analysis of vision papers concerned with livestock

Figures 20 and 21 explore the diversity of national visions regarding biodiversity in livestock systems through cluster analysis and PCA. Figure 20 identifies three distinct clusters of countries based on their thematic emphasis. Cluster 1 (in red) includes countries such as Italy, Norway, Sweden, the Netherlands, Bulgaria, and Cyprus, which tend to focus on breed diversity, climate protection, and EU-aligned strategies. These countries highlight the integration of biodiversity goals into broader environmental and climate policies. Cluster 2 (in green) comprises countries like France, Switzerland, Turkey, Lithuania, Luxembourg, Malta, Finland, and Hungary, and is associated with visions emphasising innovation, cooperation, and rural development. This cluster appears more focused on institutional and policy-based mechanisms for biodiversity preservation, rather than on-farm or ecological interventions. Cluster 3 (in blue) includes countries such as Germany, Denmark, Ireland, Greece, Poland, and Portugal, which are more strongly linked to themes such as sustainable farming, land use, and extensive management practices. This group reflects an agroecological and land-based vision for biodiversity, with closer ties to farming system structures.

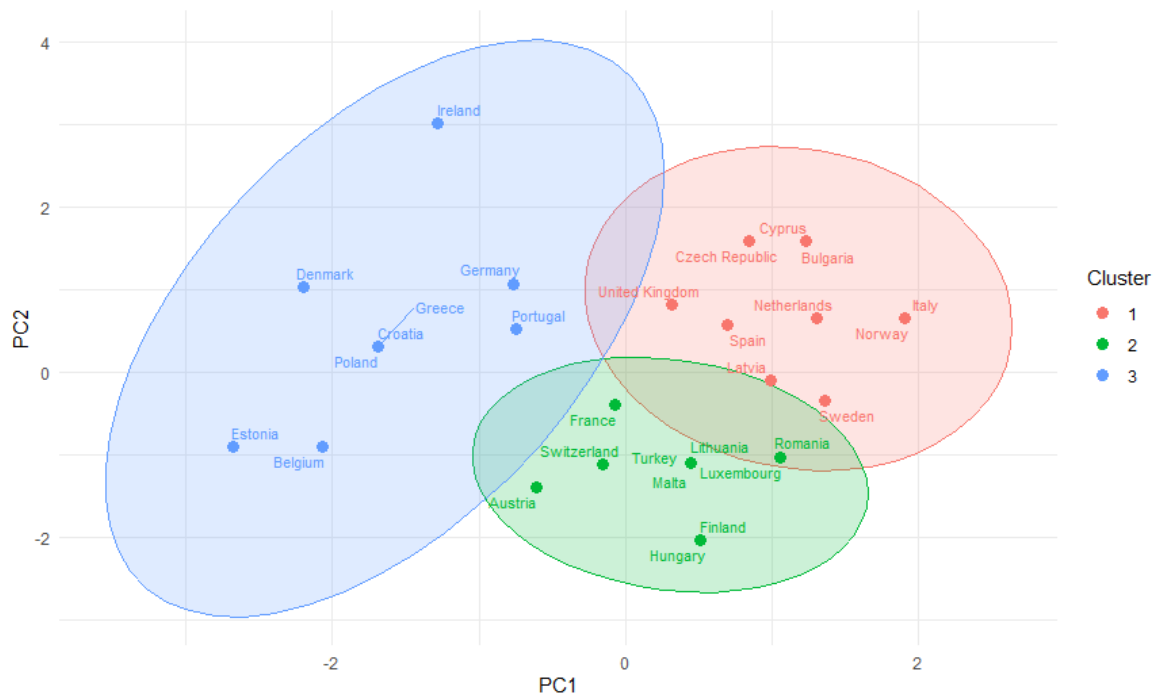


Figure 20. Identification of regional patterns in biodiversity subtopics across countries through PCA clustering

Figure 21 supports this interpretation by showing country loadings on key biodiversity subtopics. Countries such as Germany and Denmark are positioned toward vectors like sustainable farming and extensive management, while Czech Republic, Cyprus, and Bulgaria align with climate protection and substitution strategies. The Netherlands, Italy, and Norway show stronger emphasis on breed diversity, suggesting national concern for the preservation of genetic resources. Meanwhile, Lithuania, Romania, Luxembourg, and Malta are aligned with rural development, cooperation, and innovation, indicating an emphasis on structural and institutional dimensions of biodiversity. Together, the results show that while all countries acknowledge biodiversity in livestock systems, their strategic focus varies significantly from genetic conservation and climate goals to system-level change and rural innovation.

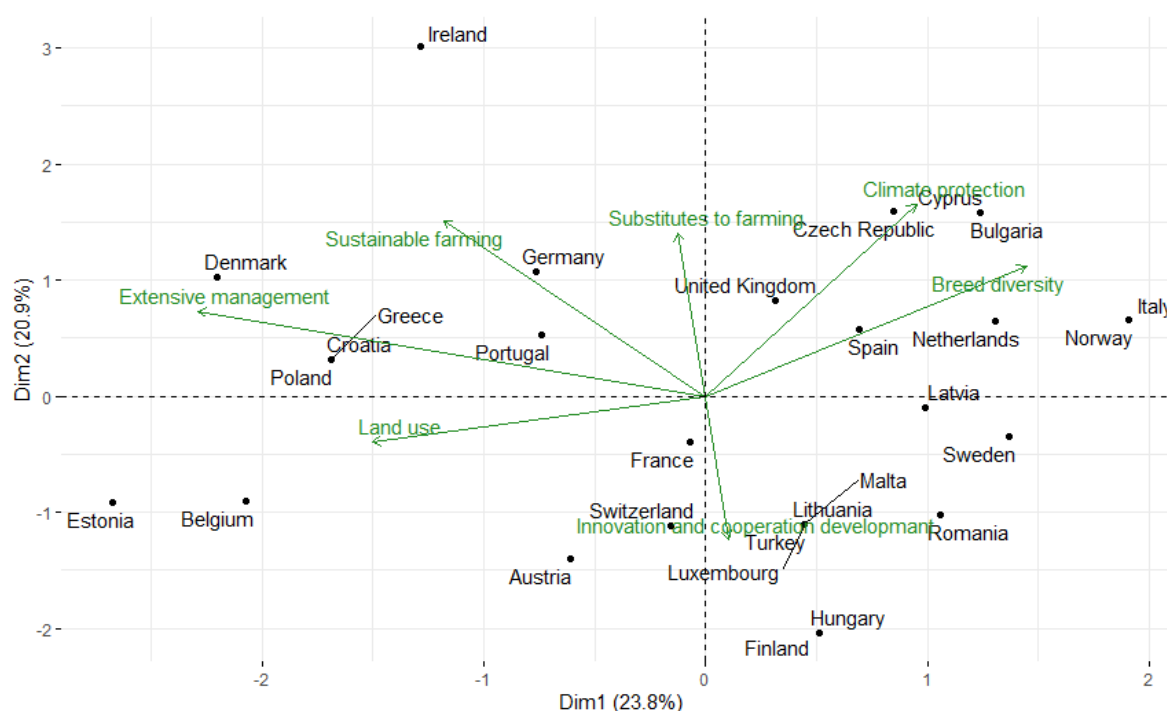


Figure 21. Visualisation of country positioning and variable loadings along the first two principal components derived from biodiversity

4. Discussion

4.1. Human nutrition and public health

This impact category evaluates the current vision of European countries regarding the different aspects of human nutrition and public health.

According to Figure 5, while a small group of countries, notably Sweden, Germany, Switzerland, Ireland, Norway, and France, emphasise sustainability and climate-friendly food systems, the majority are more strongly aligned with issues such as disease prevention, food security, obesity, and public awareness. This suggests that for the majority of countries, the focus is still on improving food quality and tackling immediate public health challenges, rather than linking these goals to broader environmental sustainability. While it's understandable that countries prioritise urgent health concerns, the relatively limited attention to sustainability in national strategies shows there's still a gap when it comes to integrating environmental and health goals. In short, sustainability isn't yet a central theme in how many countries are framing food and health policy. This highlights a missed opportunity, especially considering how closely public health and environmental issues are connected. Moving forward, there's a real need to bring these areas together more intentionally in national strategies.

Food security is explicitly highlighted only in Turkey's vision, likely due to a combination of climate-related vulnerabilities, including recurrent droughts, as well as economic pressures such as rising food prices and dependence on imported feed, and geopolitical concerns that impact food supply chains and national self-sufficiency. In contrast, most EU countries appear to address food security implicitly through broader strategies related to climate resilience, sustainable food systems, or agricultural competitiveness, rather than framing it as a standalone or urgent priority. This difference in emphasis may reflect the relative stability of food access within the EU, where food security is often considered an assumed outcome of existing agricultural, trade, and environmental policies.

Inventory and analysis of vision papers concerned with livestock

One of the key issues for the future of livestock production is reducing the competition between humans and livestock for food and other ecosystem services. In this regard, FAO estimated that one-third of human edible grains are consumed by livestock rather than humans [1]. Martin (2024) suggested that we don't need to continue pressure on ruminant production systems to minimise the consumption of human-edible grain in Total Mixed Rations [1]. Ruminants are able to digest forages, thus converting a resource of no nutritional value for humans to meat and milk that are of exceptional nutritional value. Moreover, forage-based ruminant systems are best for minimising the amount of GHG produced per kg of human-edible food [1].

To match economic and societal expectations regarding sustainability and health of our agro-food system, a conversion of the agriculture sector is necessary that targets the whole system. It means to develop the recycling technologies and integrating agricultural residues into the agri-food system. In this sense, livestock as a part of the agri-food system should reduce its own environmental impact, but also should be a part of the solution. This is somehow challenging, as it requires new responsibilities for the livestock sector to reach this target. This means that the circular and sustainable agri-food systems should integrate crop production and animal husbandry to efficiently use the renewable resources. In this way, not only will we have healthy food for human consumption, but also the agricultural residues will be reduced through the recycling of biomass, reducing GHG emissions, and maintaining the ecosystem [2].

The extensive physical and financial scale of EU livestock production carries significant environmental, economic, and social implications. Livestock farming is a crucial component of the economy, contributing to the vitality of many regions, including marginal rural areas. Its social significance extends beyond employment, as many cherished landscapes and culinary traditions in the EU have developed in tandem with livestock farming. However, this sector also has adverse environmental impacts due to the consumption of finite resources and the generation of pollutants such as nutrients, greenhouse gases, and toxic substances, which can harm biodiversity, human health, and the ecosystem functions essential for food production. Additionally, livestock production provides a variety of other goods and services [2]. Therefore, demand for livestock products in the future can be heavily moderated by socio-economic factors such as human health concerns and changing socio-cultural values [3].

National versus European/international papers

The EU vision for human nutrition and public health is closely related to livestock farming. The EU recognises that livestock farming is vital for food security and nutrition, but also acknowledges the need for a sustainable and environmentally friendly approach. The Farm to Fork Strategy promotes reducing red and processed meat intake in favor of plant-based alternatives to improve health outcomes and reduce environmental impacts such as greenhouse gas emissions and biodiversity loss¹⁴. Additionally, public health is central to this vision through the One Health approach, which highlights the connection between human, animal, and environmental health. The EU's Action Plan on Antimicrobial Resistance aims to curb antibiotic overuse in livestock to protect health. Improved animal welfare is also a priority, supporting safer and higher-quality food production¹⁵. To achieve these goals, the EU invests in transforming livestock systems with sustainable, agroecological practices, innovation, and fair food systems. Policy efforts focus on aligning agricultural regulations with sustainability, nutrition, and health objectives, including stronger animal welfare standards and equitable food chains. Ultimately, the EU seeks a livestock sector that supports

¹⁴ European Commission (2020). A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system. COM(2020) 381 final.

https://food.ec.europa.eu/system/files/2020-05/f2f_action-plan_2020_strategy-info_en.pdf

¹⁵ European Commission (2017). *EU One Health Action Plan against Antimicrobial Resistance (AMR)*.

https://health.ec.europa.eu/system/files/2020-01/amr_2017_action-plan_0.pdf

human health and nutrition while respecting planetary boundaries, aiming for a sustainable, resilient food system for people and the planet.

4.2. Greenhouse gas and ammonia emissions

The main sources of GHG emissions in livestock farming are enteric fermentation and manure management [4]. Enteric fermentation is the natural digestive process in ruminants, where microbes in the rumen of ruminants break down feed, producing methane as a byproduct. Methane is a potent trace gas due to its global warming potential, 25 times more than carbon dioxide [5]. Around 50-60% of methane emissions are from the agriculture sector, and especially from livestock farming [5].

It appears that nearly all EU countries are implementing similar action plans to mitigate GHG emissions from the livestock sector. To achieve climate neutrality by 2050, the Irish government, for instance, has proposed detailed plans for managing the sustainable ecological footprint of the dairy and beef sectors to reduce the risk of increased biogenic methane emissions from increasing livestock numbers¹⁶. In Denmark, the reductions in GHG emissions in both 2030 and 2050 result primarily from five main categories, including enteric fermentation, manure management, fertilisation, organic soils and sequestration of carbon in soils¹⁷. Emissions from livestock in Denmark will be reduced through improved feeding, targeted breeding, feed additives, new manure technologies, and in longer term through partly substituting animal-based food with plant-based food, alternative protein-based food from biotech solutions. However, in most of the EU countries, reducing the number of livestock is not planned. However, it should be noted that according to an FAO report, the demand for animal protein by continent between 2020 - 2050 suggests that Europe only needs a relative change of 1 percent in Europe (from 14.09 to 14.23) [6]. This could also be considered in the vision of the European countries to adjust the livestock production plans. The most significant changes in future demand are expected in African countries, where the demand for animal protein is projected to double by 2050 due to strong population growth. The higher demand for animal protein will lead to an increase in GHG emissions, causing global livestock emissions to nearly 9.1 Gt CO₂eq by 2050 [6]. However, in Germany, the number of livestock has slightly reduced compared to 2015, but the emissions remained the same because of increased emissions per animal. In the future, the number of livestock is expected to remain the same, while swine and poultry are projected to increase slightly [7]. In Italy, the number of cattle has reduced since 2015, and this is assumed to continue in the next years. However, swine number in Italy is predicted to increase in the future. This might result in a reduction in ammonia, and Italy would then reach the NECD emission reduction target for 2030 [7].

According to Article 4, paragraph 19, of the Paris Agreement, all countries should strive to formulate and communicate long-term low GHG emission development strategies, mindful of Article 2, taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

Annex 7 summarises the plan of European countries regarding GHG emissions. The United Nations Framework Convention on Climate Change (UNFCCC) defined the long-term and short-term targets for GHG emission reduction for each European country. According to these reports, the EU has set a target for the EU as a whole to be climate-neutral by 2050. Moreover, according to the sub-targeted GHG emission reduction, 39% of GHG emissions should be reduced relative to 2005 in the non-ETS sectors. The European countries have almost the same long-term target as the UNFCCC for reducing GHG emissions and climate neutrality. In the IPCC's Special Report on global warming of 1.5 °C, climate-neutrality has been defined as:

¹⁶ Food Vision 2030 - A World Leader in Sustainable Food Systems.

¹⁷ AgriFoodTure – Roadmap for Sustainable Transformation of the Danish AgriFood System

the concept refers to a state where human activities have no overall impact on the climate. To achieve this, we need to balance any remaining emissions with CO₂ removal and account for local effects, like changes in surface reflectivity or local climate changes, caused by human actions [8].

The targeted ammonia emissions from the European countries between 2005 – 2030 have been provided in Annex 8. The ammonia emissions from the European countries should reach 19% between 2005 – 2030. The differences in targeted ammonia emissions reduction between the European countries are due to several factors that influence the specific requirements and capacities of each nation. Ammonia emissions are significantly influenced by agricultural activities, particularly livestock farming and the use of fertilisers. Countries with intensive livestock farming or extensive use of nitrogen-based fertilisers typically have higher ammonia emissions and thus more stringent reduction targets to align with the overall EU goals for reducing air pollution and its associated health impacts¹⁸. Moreover, the initial levels of ammonia emissions can widely vary across European countries. Nations with higher baseline emissions need to undertake more significant reductions to meet the EU targets. These differences necessitate tailored reduction commitments to ensure that all countries contribute fairly to the collective goals without disproportionately affecting their economies¹⁹. Another aspect could be due to the economic considerations as the cost of implementing ammonia reduction actions can vary. Countries with higher income may have more resources to invest in advanced technologies and practices for emission reduction, while less affluent nations might face higher relative costs. This economic disparity is taken into account when setting national targets to balance environmental goals with economic feasibility [9].

According to the FAO (2023), if mitigation strategies such as feeding interventions, selective breeding for high-yield animals, and improvements in animal health and welfare are enhanced, emissions from livestock systems could be significantly reduced while achieving a 20% increase in animal protein production to meet the needs of a growing population [10]. Moreover, novel foods, including insects, have the potential to reduce the environmental impact of animal-source food (reference 18: Seyedalmoosavi et al, 2022). In the recent European Commission “Safeguarding food security and reinforcing the resilience of food systems” (March 23, 2022), innovative technologies are also reported as an essential tool for food security [11].

The comparison of national vision papers suggests that countries differ not only in their level of ambition but also in the type of strategies they prioritise. A few countries — such as France and Austria — emphasise sustainable land and nutrient management. Others, like Denmark and Norway, focus more on genetic and technical solutions, while Portugal and Serbia show interest in innovation and circular economy (Figure 9). Few vision papers present a fully integrated approach combining environmental, genetic, and system-level innovation.

Overall, across the EU, countries are employing strategies based on their national contexts, with Western Europe emphasising technology and structural transitions, Central Europe focusing on agroecology and innovation, and Eastern Europe prioritising land and soil management and carbon farming initiatives.

National versus European/international papers

The global reduction potential of the different interventions and the main assumptions are summarized by FAO, 2023 [10] as: changed in consumption of terrestrial animal source food (TASF) (4%), reducing food loss and waste (5%), productivity increases (20%), breeding (8%), rumen manipulation (5%), feed and

¹⁸ European Environment Agency:

<https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2022>

¹⁹ European Environment Agency:

<https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2022>

Inventory and analysis of vision papers concerned with livestock

nutrition improvements (12%), improved animal health (10%), carbon sequestration (7%), circular bioeconomies (5), energy use (2%), and manure management (2%).

Many of the national strategies outlined align with international climate agreements and frameworks, particularly the Paris Agreement, the EU Green Deal, and the United Nations Sustainable Development Goals (SDGs). While most countries are aligned with international frameworks, there are areas that need improvement. Nations, such as Greece, lack detailed action plans despite having defined targets. However, lower-income countries may face challenges in implementation and financing, despite well-defined goals, potentially creating a gap in meeting international commitments.

4.3. Antimicrobial resistance

Antimicrobials are essential to reduce or treat diseases caused by microorganisms in humans and livestock. However, using antimicrobials in is together with negative environmental impacts and potentially might affect both human and animal health [12]. According to the European Surveillance of Veterinary Antimicrobial Consumption (ESVAC), total antimicrobial consumption for farmed animals and aquacultures in all 31 European Countries has been estimated at 73.9 mg/PCU in 2022 [13]. Antimicrobial resistance is associated with the excessive and inappropriate use of antimicrobials in animal and human health, which causes around 33,000 human deaths in the EU/EEA [14]. The increasing rate of antimicrobials in livestock farming between 2017 and 2030 is estimated to be higher in pig production than in chicken or cattle, with pig production expected to account for 45% of the total projected increase over this time [15].

The European Union has banned the use of antimicrobials as growth promoters since 2006 and forbids their routine use [15]. International standards for veterinary products used in medicated feed are outlined in the Codex Alimentarius guidelines²⁰. These guidelines, established by the FAO and WHO in 2014, provide a framework for designing and implementing national regulatory food safety assurance programs related to the use of veterinary products in food-producing animals. Between 2018 and 2022, sales of antimicrobials in the EU-27 reduced by 28.3%, which was more than half of the 2030 Farm to Fork target strategy. However, the member States need to make further targeted efforts in order to achieve the Farm to Fork target by 2030 [16]. According to the Farm to Fork strategy, the total EU sales of antimicrobials for farmed animals and in aquaculture will reduce by 50% by 2030. Increasing the number of organic farms can be a path for reducing the use of antimicrobials in the livestock sector. Organic farming practices emphasise natural methods for disease prevention and overall animal health, reducing the reliance on synthetic antibiotics and other antimicrobials.

Overall, addressing AMR requires coordinated, cross-sectoral strategies that align with international frameworks and emphasise responsible use, surveillance, innovation, and awareness within a One Health approach.

National versus European/international papers

While international documents such as the WHO Global Action Plan and the EU One Health Action Plan provide a common framework, the vision of AMR strategies varies among EU member states due to differences in national priorities, capacities, and healthcare systems. Ensuring cross-sectoral collaboration and sustained commitment is essential for addressing the complex challenges of antimicrobial resistance.

4.4. Animal health and welfare

²⁰ Guidelines for the design and implementation of national regulatory food safety assurance programmes associated with the use of veterinary drugs in food-producing animals (CAC/GL 71-2009, adopted 2014). Food and Agriculture Organization of the United Nations & World Health Organization.

The status of animal welfare is still regarded as a challenge and will increasingly affect the future of animal farming [17]. Therefore, in the future, there will be public pressure to move towards improving the living conditions of animals, beyond the traditional approach, and to consider animal welfare at the heart of sustainable farming systems [17]. An analysis of national pathways suggested that in Europe, 44 percent of the national pathways addressed the further development of the One Health approach, 28 percent addressed animal welfare, and 22 percent addressed reducing consumption of meat, milk and dairy products, and eggs. Animal welfare was not mentioned in national pathways from other regions of the world [15].

Recently, the Commission's Directorate-General for Health and Food Safety has announced the creation of a working group focused on labelling related to the welfare of farm animals. This group will adopt a five-year program to explore the most effective strategies to better inform consumers about animal welfare. Furthermore, under the EU Farm to Fork Strategy, the EU Commission has pledged to revise multiple pieces of EU animal welfare legislation by 2023. This initiative aims to enhance animal welfare standards by aligning the regulations with the latest scientific evidence, expanding their scope, and simplifying enforcement.

While all EU countries are bound by common regulations to protect farm animals, the level of implementation and enforcement varies widely. Western European countries lead in both legislative depth and enforcement, supported by public demand for ethical farming practices. Central and Eastern European countries, while increasingly aligned with EU regulations, face economic and enforcement challenges that limit their ability to fully adopt higher welfare standards. The ongoing evolution of animal welfare policies in these regions indicates a growing awareness and commitment, but the pace of change will depend on both domestic pressures and EU-wide advocacy efforts.

National versus European/international papers

When comparing European countries' visions for animal welfare and health with international documents, such as those from the World Organisation for Animal Health (WOAH)²¹, the World Health Organisation (WHO)²², and various global standards, several key points emerge. WOAH provides guidelines and standards for animal health, including disease control, biosecurity, and welfare. WOAH's welfare standards focus on humane treatment of animals, including welfare during transport and slaughter. They are intended to be used as a benchmark for member countries. In addition, WHO promotes the One Health approach, which integrates human, animal, and environmental health. This holistic perspective is crucial for managing zoonotic diseases and ensuring overall health. Germany, Denmark and Ireland are examples of national strategies with a strong One-Health approach.

The Codex Alimentarius²³ sets international food safety and quality standards, including those for animal products. These standards help ensure that animal health and welfare contribute to safe food production.

European countries generally have stringent animal welfare laws that align closely with EU regulations and often exceed international guidelines. For instance, EU regulations on animal welfare during transport and at slaughter are among the most comprehensive globally. On the other hand, international standards such as WOAH and Codex provide broad guidelines that member countries are encouraged to adopt, but

²¹ <https://www.woah.org/en/who-we-are>

²² World Health Organization (WHO). (2023). One Health. Retrieved July 9, 2025, from <https://www.who.int/news-room/fact-sheets/detail/one-health>

²³ Food and Agriculture Organization & World Health Organization. (n.d.). Codex Alimentarius. Retrieved July 9, 2025, from <https://www.fao.org/fao-who-codexalimentarius/en/>

enforcement and implementation vary. In Europe, there is a strong focus on high welfare standards, including humane treatment, enriched environments, and higher living conditions for farm animals. The use of welfare labels and public awareness campaigns is prevalent. However, international guidelines emphasise humane treatment and welfare, but may not be as detailed or stringent as EU regulations. To improve livestock health and welfare, European countries invest significantly in veterinary research, technology, and disease monitoring. They integrate advanced technologies and data analytics to enhance animal health management. However, international standards such as WOAHP support advancements in veterinary care and disease prevention through its standards and guidelines, but do not dictate specific technologies or research priorities. European countries often lead in this area by adopting cutting-edge practices.

Animal welfare is an important aspect for long-term sustainability and development. Improving animal health and welfare is, together with improving biodiversity, reducing the environmental impact of livestock farming. In this regard, there is a strong focus on integrating animal welfare with environmental sustainability in Europe. Efforts include reducing the environmental impact of livestock farming and addressing climate change. On the other hand, international documents provide general guidelines on sustainability but do not always offer detailed protocols.

4.5. Biodiversity

Current evidence is showing that the world is on the cusp of the sixth mass extinction of species. The latest study of the state of the world biodiversity by the International Science-Policy Platform on Biodiversity and Ecosystem Service (IPBES, 2019) estimated that in animal and plant groups assessed, an average of 25 % of species are threatened, and around 1 million species are at risk of extinction within the next few decades. This high rate of extinction is a direct result of human activity [18]. The environmental changes caused by human activities have threatened biodiversity of many species. The main driver of biodiversity loss is the land use change for different activities such as agriculture, forestry, urbanisation, or infrastructure development [18]. Therefore, actions to reduce biodiversity loss need to be scaled up soon.

It has been suggested that the negative impact of livestock farming on the environment and biodiversity must be reduced [19]. In this regard, the EU Green Deal opens the way towards improving biodiversity. The EU Biodiversity Strategy for 2030 is one of the key components of the EU Green Deal. The EU Biodiversity Strategy for 2030²⁴ addresses the five main drivers of biodiversity loss, sets out an enhanced governance framework to fill remaining gaps, ensures the full implementation of EU legislation, and pulls together all existing efforts.

Current EU laws on nature restoration have gaps, including the lack of mandatory plans, clear targets, and comprehensive monitoring. Therefore, to address this, the EU will:

- 1- Set Binding Targets: Propose legal targets by 2021 to restore ecosystems for carbon capture and disaster reduction, with guidelines for assessing and achieving ecosystem health.
- 2- Improve Implementation: Require Member States to prevent habitat and species decline by 2030 and improve the status of at least 30% of currently poor conditions, with guidance provided to Member States.

Biodiversity significantly impacts public health and nutrition, particularly through diverse livestock species and breeds. High-income countries have seen a reduction in breed diversity, with a few high-output breeds

²⁴ COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS EU Biodiversity Strategy for 2030 Bringing nature back into our lives.

dominating. Ecosystem services reliant on biodiversity are important for human health, making biodiversity conservation and sustainable use essential global responsibilities [20]. A study found that higher species richness, or the variety of species consumed daily, was positively linked to better nutrient adequacy and dietary diversity among women and children in rural areas [21].

National versus European/international papers

When comparing the biodiversity strategies found in national vision papers with international frameworks such as the EU Biodiversity Strategy for 2030, the Convention on Biological Diversity (CBD), and findings from the IPBES Global Assessment, we see both encouraging progress and noticeable gaps. Many European countries have started to align their national goals with international targets. Countries like France, Germany, Ireland, and Italy, for example, have developed dedicated biodiversity strategies that support broader EU and global ambitions. These include goals such as protecting at least 30% of land and marine areas by 2030, promoting agroecological practices, and preserving local livestock breeds. However, the level of commitment and detail varies across countries. Some nations have clear targets and strong links between biodiversity and livestock farming, while others only mention biodiversity in general terms without specifying actions or indicators. In particular, countries in Eastern and Southern Europe often express support for biodiversity protection but lack concrete implementation plans or monitoring systems.

Another important observation is that biodiversity is still too often treated as a separate issue. While international frameworks increasingly emphasise the need to link biodiversity with climate action, public health, and sustainable food systems, many national vision papers do not yet fully make these connections, especially within the livestock sector. For example, the role of extensive grazing, mixed crop-livestock systems, or preserving genetic diversity in farm animals is not always recognised as part of biodiversity strategies. This shows there is still work to do in terms of better integrating biodiversity into national livestock policies and ensuring stronger alignment with international standards. For the STEP UP project, these findings are particularly relevant: they highlight where additional policy support and knowledge exchange could help countries strengthen their approach and meet both EU and global biodiversity goals.

In short, there is still a need for higher consistency, clearer targets, and better integration of biodiversity into the broader transformation of livestock systems. International frameworks provide a strong foundation.

4.6. Implications for EU Livestock Policy and STEP UP

The findings of this deliverable provide essential insights that, together with the results from T1.5 and T6.4, contribute to the objectives of STEP UP, to support the transition towards sustainable, resilient, and evidence-based livestock policies across Europe. By systematically analysing national and regional vision papers from 31 European countries, this study highlights both convergences and divergences in how member states conceptualise and operationalise sustainability within the livestock sector. These insights are necessary for STEP UP policy development, modelling frameworks, and a multi-level governance approach in the diversity of existing national contexts.

A key implication of this work is its contribution to understanding how national strategies align with the EU's Farm to Fork Strategy, the European Green Deal, the Biodiversity Strategy for 2030, and other components of the broader EU livestock farming policy framework. While many vision papers show alignment with EU-level targets, for example, through commitments to reduce GHG and ammonia emissions, promote biodiversity, or improve animal welfare, the degree of implementation, specificity of actions, and strength of enforcement mechanisms vary widely. This highlights the need for targeted policy upgrading mechanisms that consider national capacities and regional challenges. For the STEP UP initiative,

this deliverable identifies both opportunities and systemic gaps that should be addressed in the policy innovation process.

Specifically, the results point to:

1. Human nutrition and public health: Different approaches in Northwestern, and Central and Eastern European countries
2. GHG and ammonia emissions: Broad engagement, with multiple sectoral approaches
3. Antimicrobial resistance: Notable relative consistency across countries
4. Animal health and welfare: Focus on legislation and alignment within Europe
5. Biodiversity: Different approaches to enhance biodiversity, with remaining potential to be integrated with other categories
6. Little alignment between livestock intensification trends and the goals of agro-ecological transition.

The findings of this review offer rich evidence for identifying where policy frameworks need to be upgraded, harmonised, or better aligned with EU strategic objectives. They also offer concrete entry points for the co-design of policy pathways in collaboration with stakeholders across governance levels. By mapping current national visions, this deliverable sets the stage for the next phases of STEP UP to evaluate the effectiveness of existing instruments, support Living Lab experimentation, and develop adaptable policies that bridge the gap between ambition and implementation. In addition, the review also strengthens the project's ability to recommend policy options.

5. Conclusion

This review highlighted the diversity and complexity of national livestock visions across Europe. While many countries align with EU-level strategies such as the Farm to Fork Strategy, the Green Deal, and the EU Biodiversity Strategy for 2030, the depth and clarity of national visions vary widely. Some countries demonstrate clear commitments through measurable targets and integrated approaches, while others present broader, less concrete goals or lack alignment with international frameworks. Across all five assessed impact areas: public health, emissions, antimicrobial resistance, animal welfare, and biodiversity, certain cross-cutting themes emerged. Western and Northern European countries are generally more advanced in integrating sustainability, One Health, and animal welfare into their livestock visions. These countries also tend to include clearer policy instruments, targets, and cross-sectoral coordination. In contrast, many Southern and Eastern countries focus more on productivity, food security, and modernisation, often with a minor emphasis on biodiversity, climate, or livestock welfare perspectives. A gap lies in the limited use of specific targets, monitoring frameworks, and funding mechanisms, particularly in the areas of biodiversity and livestock welfare. While biodiversity is often acknowledged, it is rarely positioned as a core objective. Similarly, most countries emphasise antimicrobial resistance through surveillance and awareness, but fewer include structural reforms or incentives for reducing usage in livestock. The review also shows that while many countries acknowledge the impact of livestock on climate and the environment, only a few have outlined clear and ambitious strategies to drive real change. These include approaches like circular farming, conserving native breeds, or using practices that store carbon in soils and grasslands. To support the EU's long-term climate neutrality, health, and biodiversity goals, and to guide effective policy development (under the STEP UP project), national strategies could include more measurable goals, stronger cross-sectoral integration, and more robust support for farmers and stakeholders. Building on existing efforts, future visions could embrace a systems-thinking approach, connecting animal production with human health, ecosystem restoration, and food system resilience.

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Annexes

Annex 1. List of national vision papers

Country	Report title
Austria	Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie. (2021). <i>Langfriststrategie 2050: Klimaneutralität Österreichs</i>
Belgium	Departement Landbouw en Visserij. (2022). <i>Vlaams GLB Strategisch Plan 2023–2027</i>. Vlaamse overheid
Bulgaria	Government of Bulgaria. (2020). <i>Voluntary National Review: Sustainable Development Goals</i>. United Nations High-Level Political Forum
Croatia	Government of Ireland. (2020). <i>Beyond the farm: A vision and roadmap for the transformation of agriculture and rural space</i>. Department of Agriculture, Food and the Marine.
Cyprus	Ministry of Agriculture, Rural Development and Environment. (2022). <i>Cyprus' CAP Strategic Plan: At a glance</i>. Government of Cyprus.
Czech Republic	Office of the Government of the Czech Republic. (2017). <i>Strategic Framework Czech Republic 2030</i>.
Denmark	Olesen, J.E., Christensen, S., Jensen, P.R., Schultz, E., Rasmussen, C., Kjer, K.H., Kristensen, T.N., Gade, J., Haslund, S., Henriksen, C.B. and Persson, M., 2021. <i>AgriFoodTure: Roadmap for sustainable transformation of the Danish Agri-Food system</i>. Edited by Rasmussen, C., Kjer, K.H., Kristensen, T.N., Gade, J.J., Haslund, S., Henriksen, C.B., Persson, M., Kryger, K., and Henriksen, L. SEGES, Aarhus, Denmark. 96 pp.
Estonia	Ministry of Regional Affairs and Agriculture. (2022). <i>Estonia's CAP Strategic Plan 2023–2027</i>. European Commission.
Finland	- Ministry of Agriculture and Forestry, Finland. (2020). <i>Vision 2040 for Finnish food production</i>. - Huttunen, R., Kuuva, P., Kinnunen, M., Lemström, B., & Hirvonen, P. (2022). <i>Carbon neutral Finland 2035–national climate and energy strategy</i>.
France	Care, I. (2018). <i>National Low Carbon Strategy Project. The ecological and inclusive transition towards carbon neutrality. Project version-December 2018. The ecological and solidary transition towards carbon neutrality</i> (No. INIS-FR--19-0878). Ministère de la transition écologique et solidaire, 244, Boulevard Saint Germain, 75007 Paris (France).
Germany	Landwirtschaft, Zukunftskommission. Zukunft Landwirtschaft-eine gesamtgesellschaftliche Aufgabe: Empfehlungen der Zukunftskommission Landwirtschaft-Kurzfassung. Zukunftskommission Landwirtschaft, Geschäftsstelle, 2021.
Greece	Hellenic Republic, Ministry of Agricultural Development & Rural Development, Fisheries Directorate General, Aquaculture & Aquaculture Directorate Inland Waters. 2014. <i>Multiannual National Strategic Plan for the Development of Aquaculture in Greece, 2014–2020</i>. Athens: Ministry of Rural Development and Food.
Hungary	Bálint, C. (2022). <i>MAP Position Paper (Hungary) – Towards sustainable and resilient value chains</i>. Members of the SHERPA Hungarian Rural Prosperity Multi Actor Platform (Contributors).

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	Ministry of Foreign Affairs and Trade of Hungary. 2018. Voluntary National Review of Hungary on the Sustainable Development Goals of the 2030 Agenda: transformation towards sustainable and resilient societies
Italy	Ministry of the Environment and Land and Sea Protection. 2017. National Strategy for a Sustainable and Inclusive Agricultural, Food and Forestry System
Ireland	Department of Agriculture, Food and the Marine. (2021). <i>Food Vision 2030: A world leader in sustainable food systems</i>. Government of Ireland.
Latvia	- Organisation for Economic Co-operation and Development (OECD) Staff. 2019. <i>Innovation, Agricultural Productivity and Sustainability in Latvia</i>. OECD. <i>Implementation of the Sustainable Development Goals</i>. Government of Latvia (2018).
Luxemburg	Ministère de l'Agriculture, de la Viticulture et du Développement rural. <i>Plan stratégique national du Grand-Duché de Luxembourg 2023–2027: Assurer un développement durable du secteur agricole</i>. Version 3.2, 2024
Lithuania	Lithuanian Government. (2018). <i>Voluntary National Review on the implementation of the UN 2030 Agenda for Sustainable Development in Lithuania</i>. United Nations.
Malta	- Ministry for the Environment, Sustainable Development and Climate Change. (2021). <i>Malta's Sustainable Development Vision for 2050</i>. Government of Malta. - Energy and Water Agency. (2023). <i>Draft National Energy and Climate Plan 2021–2030</i>. Government of Malta.
Netherlands	- Ministry of Agriculture, Nature and Food Quality. (2019). <i>Plan of action – Supporting the transition to circular agriculture</i>. Government of the Netherlands - Long term strategy on climate mitigation
Norway	- Norwegian Ministry of Climate and Environment. 2020. Norway's Climate Action Plan for 2021-2030. - Ministry of Economic Affairs and Climate Change. 2019. Norway's Climate Strategy for 2030: a transformational approach within a European cooperation framework
Poland	Carbon Free Europe. 2021. <i>Poland's pathways to net-zero emissions</i>.
Portugal	- Government of Portugal. 2020. <i>Agenda de Inovação para a Agricultura 2020–2030</i>. - Government of Portugal. (2019). <i>Roadmap for Carbon Neutrality 2050 (RNC2050): Long-term strategy for carbon neutrality of the Portuguese economy by 2050</i>. Ministry of Environment and Energy Transition
Romania	Government of Romania. 2023. <i>Long-Term Strategy of Romania</i> (Version 1.0). Ministry of Environment, Waters and Forests
Serbia	Government of the Republic of Serbia. (2014). <i>Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014–2024</i>. Official Gazette of the Republic of Serbia, No. 85/2014
Slovenia	Rac, I., & Erjavec, E. (2021). <i>MAP Position Paper (Slovenia) – Contribution from 20 Science-Society-Policy Platforms to the Long-Term Vision for Rural Areas</i>. Zenodo.
Spain	- Government of Spain. (2022). <i>CAP Strategic Plan 2023–2027</i>. Ministry of Agriculture, Fisheries and Food. - Ministry for Ecological Transition and Demographic Challenge. 2019. <i>Just Transition Strategy</i>.
Sweden	Sweden, M. O. E. (2020). Sweden's Long-Term Strategy for Reducing Greenhouse Gas Emissions. <i>Ministry of Environment (MOE), Government Offices of Sweden: Stockholm, Sweden</i>.

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	• Government Offices of Sweden. (2017). <i>A national food strategy for Sweden – more jobs and sustainable growth throughout the country</i>. Short version of Government bill 2016/17:104. Ministry of Enterprise and Innovation.
Switzerland	• Federal Council of Switzerland. (2021). <i>Switzerland's Long-Term Climate Strategy</i>. Federal Office for the Environment.
Turkey	• General Directorate of Agricultural Research and Policies. (2015). <i>National Strategy and Action Plan for Animal Genetic Resources of Turkey</i>. Ministry of Food, Agriculture and Livestock. ISBN 978-605-9175-14-2 • Republic of Turkey, Ministry of Environment, Urbanization, and Climate Change. 2024. <i>Long-Term Climate Strategy 2053</i>.
United Kingdom	• Department for Environment, Food and Rural Affairs. 2022. Government food strategy. • DEFRA, U. 2020. <i>The path to sustainable farming: an agricultural transition plan 2021 to 2024</i>.

Annex 2. Strategies and goals from the national vision papers: Human nutrition and public health

Country	Strategies and goals
Germany	• By 2050, improving ecological, economic, social and health functions of sustainable agricultural and food systems to ensure sufficient access to healthy food.
Denmark	• Moving towards eating healthy and sustainable plant-based diet
Ireland	• Coherence of policies for food, health and nutrition; Enhancement of consumer trust through providing evidence of safe and ethical food production; Creation of value-add, through insight and innovation
Italy	• Decrease population exposure to environmental and anthropogenic risk factors • Spreading healthy lifestyles and strengthening prevention systems • Ensure access to effective health and treatment services
Norway	• Action to reduce food waste and to encourage people to follow the dietary recommendations from the Directorate of Health • People need to eat more fish, whole-grain foods, fruit, and vegetables, and limit the amount of red meat and processed meat in their diet. • Central government agencies will buy healthier, more sustainable, and more climate-friendly food in line with the Directorate's recommendations
Austria	• Improvement of health and quality of life by enhancement of nutritional and health behavior • Strengthening the field of nutrition in all areas of society • Dismantling of health inequalities • Accessibility of a healthier diet for all • Preventing of nutrition therapy in the health care system • Strengthening of nutrition therapy in the health care system
Ireland	• Prioritizing safe, nutritious, and sustainable food • Enhancing nutrition and health outcomes • Supporting consumer education and food literacy • Tackling food insecurity and ensuring affordability • Supporting research and innovation in nutrition • Global leadership in sustainable nutrition
Italy	• Improving access to health services and contributing to the expansion of universal health coverage • Strengthening primary health care systems and training of health personnel • Countering risk factors and the impact of health emergencies: refining early warning and prevention mechanisms • scientific research, the promotion of a culture of health and of prevention • Working for a strong revitalization of public health functions, support for health reforms
Netherlands	• Promoting healthy diets • Creating supportive food environments • Public health campaigns and education • Policy recommendations
Norway	•
Switzerland	• Promoting health through diets • Reducing chronic diseases • Ensuring sustainability through coordinated policies and strategies

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Belgium	• Preventive health • Health equity • Sustainable food system • Mental and physical health integration
Bulgaria	• Tackling childhood malnutrition • Addressing obesity and non-communicable diseases • Nutritional policy • Improving maternal and infant nutrition
Turkey	• Nutritional health and disease prevention • Food safety and security • Public health programs • Integration with sustainable food systems
Estonia	• Nutritional health promotion • Nutrition and diet • Policy gaps and improvement
Finland	• Promoting healthy eating habits • Food fortification programs • School nutrition standards • Food 2030 strategy • Preventing obesity and chronic diseases
France	• Improving public health through diets • Sustainability and climate goals • Addressing malnutrition and inequality • Interministerial and community actions • Nutrition-sensitive food policies
Greece	• Malnutrition and child health • Preventing diet-related diseases • National nutritional policies • Public awareness and campaigns
Poland	• National health policy • Obesity and diet related diseases • Healthy future strategy: to improve quality of healthcare systems
Serbia	• No clear strategy was found
Portugal	• Promotion of healthy diets • Food reformulation and tax policies • Public awareness and education • School and public health integration
Slovenia	• New guidelines expected to be finalized by the end of 2024
Spain	• Obesity and diabetes • Diet-related non-communicable diseases • Public health policies and food environment
Sweden	• Improving public health policies • Shift towards more sustainable food and healthier diet
Switzerland	• Healthy diet promotion • Sustainability and food systems • Multi sector collaboration
Croatia	• Healthy diets and

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United kingdom	• Child nutrition programs • Promoting healthy eating and physical activity • Improving early nutrition • National obesity strategy
Cyprus	• Disease prevention and health promotion • Food safety and hygiene • Multi-sector health approach
Czech republic	• Nutritional health campaigns and education • Collaboration with EU standards
Hungary	• Public health product tax: to reduce consumption of harmful products • Regulation on salt and trans fats • School food regulations • Obesity prevention programs
Latvia	• Nutritional education and health promotion • School nutrition programs • Physical activity and obesity prevention • Health inequalities reduction • Food marketing regulations
Luxembourg	• Research and public health initiatives • Nutria-score labeling • Campaigns to reduce obesity
Lithuania	• Public awareness campaign • Food standards in public institutions • Nutrition education and skills • Food marketing regulations • Policy gaps
Malta	• Obesity prevention • School nutrition policies • Early life nutrition improvements • Health promotion and disease prevention
Romania	• Childhood obesity prevention • Nutrition education and public health campaigns • Maternal health

Annex 3. Strategies and goals from the national vision papers: GHG and ammonia emissions

Country	Strategies and goals
Germany	• Adapting the size of cattle herd to climate target • Optimising fertiliser and feed management • Improving the lifetime performance of dairy cows
Denmark	Until 2030: • Improved feeding, targeted breeding, manure management, advanced technological solutions, research and infrastructure development and in longer term through partly substituting animal based food with plant based food alternative protein based food Until 2050: • Methane mitigation in diets: develop new methane-reducing feed additives, optimize fat inclusion in ruminant diets, identify diet compositions that minimize carbon footprint • Microbial & Genetic Strategies: study microbial interactions in methane emissions and nitrogen cycling, analyze host genetics and gut microbiome influence on emissions, develop genomic selection models for low-emission breeding • Nutrient efficiency: improve intestinal amino acid digestibility in monogastrics, refine amino acid requirements in dairy cows • Plant based diets
Ireland	• Biogas methane: reduction of at least 10% by 2010, which needs to adjust in line with emerging national and international targets. • Nitrous Oxide: emissions associated with chemical fertilizer use to reduce by more than 50% by 2030
Italy	• By 2030, reduce the per capita negative environmental impact of cities, paying special attention to air quality and management of municipal and other wastes • Integrating climate change measures into national policies, strategies, and planning
Netherlands	• Sustainable energy systems • Efficient use of infrastructure, greater resilience of the energy system • Transition to a climate-neutral and circular society • Emission free stables, improved manure processing
Norway	• Research and innovation developments • Breeding programmes
Switzerland	Until 2050: • Carbon footprint of food production decreasing thanks to promotion of sustainable food system. • GHG emission from domestic agriculture production reduced by at least 40% compared with 1990 • Swiss agriculture contributes at least 50% to food supply
Belgium	Until 2050: • In the Wallonia region: carbon neutrality by reduction of GHG emission by 95% compared to 1990. In the Flanders: reducing GHG emissions from non-ETS sectors by 85% compared to 2005. Brussels-Capital Region: carbon neutrality by 2050.
Bulgaria	• Adoption of climate-smart agricultural practices to reduce CH₄ from livestock and N₂O from fertilizer use. • Development of carbon farming initiatives and sustainable soil management. • Compliance with the National Emission Ceilings (NEC) Directive: 1% reduction by 2030 compared to 2005 levels. • Improving fertilizer management: precision farming, low-emission manure storage

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	• Financial support for national programs to support emission reduction projects
Austria	• Promotion of agroecological practices, reduced tillage, and organic farming. • Encouragement of carbon sequestration through soil management and reforestation efforts. • Compliance with the NEC Directive to reduce NH3 emissions • Improved manure management and precise agriculture • Providing financial support practices such as: carbon pricing, funding projects
Turkey	• Reducing methane emissions from livestock • Ensuring efficiency in the use of chemical fertilizers • Minimizing the use of pesticides and antimicrobials • Improving the management of loss, waste, and residues in agricultural production • Enhancing land and soil management • Providing farmers with access to suitable financing options • Expanding training, awareness, and capacity-building activities for stakeholders in the agricultural sector, with a focus on gender balance • Increasing manure process in biogas plants
Estonia	• Increasing and maintaining soil's carbon stock including developing and maintaining significant carbon stock of land areas. • Encouraging efficient and ecological use of agricultural land while avoiding the falling out of agricultural use of such land. • Enhancing the use of plant nutrients and replacement of mineral fertilisers with organic fertilisers and eco-friendly soil conditioners. • Enhancing the production of bioenergy • Increasing the productivity of agriculture, with the focus manure management • Increasing forest growth and the carbon sequestration ability through productive and sustainable forest management. • Facilitating preservation of the current forest land and in other categories of land while preferring techniques of increasing carbon sequestration and emission reduction. • Facilitating research, development and innovation to increase sustainable agriculture
Finland	• Increasing renewable energy capacity and use account for 50% of total energy consumption • Supporting carbon capture and storage • Improving fertilizer management using precision farming and slow-release fertilizers • Improving manure management using new technologies • Improving dietary strategies for reducing ammonia emissions
France	• Enhancing carbon sinks through afforestation, reforestation, and sustainable forest management practices • Support for carbon farming initiatives to increase soil carbon storage and promote regenerative agriculture • Precise farming and manure management for reducing ammonia emissions • Dietary adjustment for livestock farming
Greece	The national target is defined. But still there is no action plan
Poland	Using energy saving technologies Promoting renewable energy sources Using new technologies for using vegetal products as energy, and using biogas from manure
Serbia	• Planting of winter cover crops • Legume planting on temporary grassland: • Lipid supplementation in animal diets • Precision Farming Techniques • Anaerobic digestion for manure management
Portugal	• Promoting sustainable agriculture by expanding conservation and precision farming, cutting emissions from livestock and fertilizers, and encouraging innovation

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	• Encouraging carbon sequestration through active agricultural and forest management, promoting valorisation of the territory • Moving towards circular economy
Slovenia	• -
Lithuania	• Investments towards improving equipment and technologies for manure management • Promoting consumption of organic products and plant based diets • Encouraging farmers to graze livestock extensively on grassland • Improving feed formulations • Promoting organic farming • Informing people about negative aspects of unsustainable farming • Balanced fertilizer system with efficient use of mineral fertilizer
Malta	• Ensure sustainable irrigation for crops • Use animal and agriculture waste and residues as a source • Reducing use of chemical N-fertilizers and other inputs with similar high carbon footprint • Assess the feasibility of methane-inhibiting vaccines • Manure and slurry management • Aquaponics and vertical farming • Modification of ruminant diets
Romania	• Changing diet to reduce enteric fermentation • No burning agriculture residues • Emission factor of FSN_N in synthetic fertilizer will be reduced by 10% • Using methane emissions of manure for producing biogas • Using solar energy • Projections for the population of each livestock category

Annex 4. Strategies and goals from the national vision papers: Antimicrobial resistance

Country	Strategies and goals
Germany	• Promote responsible antibiotic use • Enhance surveillance • Support innovation • Raise awareness • Collaborate globally within the "One Health" framework
Denmark	• Responsible antibiotic use • Monitoring use of antimicrobials • Investments on research and innovation • International collaboration
Ireland	• Raising awareness • Enhanced monitoring of antimicrobial use • Reducing infectious • Optimizing antimicrobial use • Promoting research investments
Italy	• Improving monitoring on antimicrobial use • Infectious prevention and control • Promoting rational antimicrobial use • Regional autonomy in implementation action plans
Netherlands	• Promoting responsible antibiotic use • Monitoring and data collection • Improving infection prevention • International collaboration
Norway	• Monitoring program • National action plans targeting to reduce antimicrobial use • Infection control • Research and policy development
Switzerland	• Promoting responsible antimicrobial use • Monitoring use of antimicrobial • Infectious prevention and control • Research and development • Public awareness • International cooperation to align the national strategies with global initiatives
Belgium	• Coordinating and governance • Monitoring • Public awareness and education • Legalization and regulation
Bulgaria	• Monitoring • Public awareness campaigns • International cooperation • Promoting responsible antimicrobial use
Austria	• Austria's national action plan • Reducing unnecessary antibiotic use • Strengthening infection prevention • development of new antimicrobial agents
Turkey	• National action plans in line with the WHO guidelines

Inventory and analysis of vision papers concerned with livestock

	• Strengthening monitoring and diagnostics • Regulations to ensure antibiotics are prescribed only when necessary • Public awareness
Estonia	• One Health Approach • Public Education and Training
Finland	• Enhancing infection prevention • Promoting rational antibiotics use • One health approach • Public education • Improving research and development • Improving international cooperation
France	• Public awareness • Monitoring • Research funding
Greece	• Infection Control • Public awareness
Poland	• One health approach • National programs empathize on enhancing lab capabilities, improving education and healthcare
Serbia	• National action plan is currently in the process of being monitored and financed
Portugal	• One health approach • Reducing antibiotic consumption by 20% by 2030 • Promotion of the 'Access' Group: in 2023, Portugal's usage in this group was 63% • Monitoring and data collection
Slovenia	• Optimizing antibiotic use • Monitoring • Public awareness • Environmental impact addressing factors contributing to reduce use of antibiotics
Spain	• Monitoring antibiotic consumption and resistance patterns • Control Measures • Prevention • Research development • Training development and education • Communication to improve awareness
Sweden	• Monitoring • Regulation and reduction of antibiotic use • Collaboration and international support • Public awareness
Croatia	• National actions including enhancing data monitoring and ensuring rational antimicrobial use • Public awareness to reduce unnecessary antibiotic consumption • Collaboration with European initiatives and WHO guidance
United kingdom	• Five-Year National Action Plans (NAPs) to control AMR by 2040 • Strengthening monitoring • Innovation and research • Public awareness • Infection prevention and control • One health approach

Inventory and analysis of vision papers concerned with livestock

Cyprus	• One health approach • Reduce the spread of resistant bacteria • Promote the prudent use of antibiotics • Enhancing infection control practices • Supporting alternative antibiotics
Czech republic	• Increased monitoring • Proper regulation of antibiotic use • Support for research on alternatives to antibiotics
Hungary	• Controlling infections and promoting the rational use of antibiotics
Latvia	• Reducing 0% of total consumption of antibiotics in humans • At least 65% of total consumption of antibiotics in humans belongs to the access group • Reducing 6% of total incidence of infectious
Luxembourg	• Governance establishing national oversight to coordinate efforts across sectors • Prevention, education and communication • Treatment and diagnosis • Monitoring
Lithuania	• Promoting rational prescribing • Ensuring effective prevention and control measures in health care settings
Malta	• Strengthening governance and legislation • implementing One Health • Monitoring use of antimicrobials • Enhancing infection prevention • Raising awareness through education • Improving and supporting research and international collaboration
Romania	• Enhancing knowledge and attitudes of medical professionals towards judicious antibiotic use • Optimizing antibiotic use across sectors • Preventing infections through effective healthcare measures

Annex 5. Strategies and goals from the national vision papers: Animal health and welfare

Country	Strategies and goals
Germany	• Legal framework and constitution • Animal transport and export • Public awareness and retail initiatives reflecting changing consumer preferences
Denmark	• Comprehensive animal welfare agreement • Sustainability and education • Legislation • Industry innovation
Ireland	• Partnership and dialogue • Science evidence-led policies • Regulation and funding improvements • Education and awareness • High-welfare farming system
Italy	• Legislative reforms • Cooperative and public advocacy • Sustainable food policies • Wildlife and companion animal
Netherlands	• Comprehensive legislation regarding housing, breeding and medical treatment of animal • Animal experiment regulation • Enforcement mechanisms • International leadership to improve welfare standards
Norway	• Animal welfare act (2009): aims to safe animal from unnecessary suffering • Man harmful breeding practices • Proactive industry initiatives • Ethical and activist engagement
Switzerland	• Animal Welfare Legislation • Support for ethical farming • Scientific principle for animal experiment • Public involvement • High animal welfare standards in agriculture • Animal rights campaigns
Belgium	• Legislation and policy • EU leadership
Bulgaria	• Animal Protection Act (2008, amended 2011) • Active organization • Public awareness and cultural considerations
Austria	• Animal Welfare Act (Tierschutzgesetz, 2005) • Integrated animal welfare into its federal constitutional framework • Regional protection • Animal welfare council: consulting with dedicated council on animal protection, ensuring that policies reflect current best practices and scientific understanding • Focus on ethical farming
Turkey	• There are some progress regarding pets but not for farm animal
Estonia	• Animal Protection Act (2000, updated 2017) • Animal farming regulations for farming

Inventory and analysis of vision papers concerned with livestock

	• Wildlife protection • Aligning with EU policies
Finland	• Animal Welfare Act (1996, updated 2024) • Ban on harmful practices • 2024 amendments: to enhance animal protection around breeding
France	• No farm animal welfare action and strategy was found
Greece	• Legislation framework improvements • Animal rights aligning with international laws • Public awareness and funding
Poland	•
Serbia	• Animal Protection Act (1997) • Recent legislative changes (2018 amendments) to increase penalties for animal abuse • Debates on religious slaughtering • Increasing alignment of policies on animal welfare with EU standards • Improving environmental and agriculture strategies
Portugal	• Updating and modernizing animal welfare laws • Municipal and NGO Collaboration • Public awareness
Slovenia	• Promoting animal welfare standards • Improving the living conditions of farmed animals and ensuring that animal products are not imported from countries with lower welfare standards • Public and policy support
Spain	• Strict Breeding Regulation
Sweden	• Comprehensive Legislation ensuring all animal are treating humanly • Sustainable farming practices to enhance farm animal protection • Animal welfare research
Croatia	• Veterinary Education and Training • Sustainability and rural development: to align Croatia's policies animal welfare with sustainable agriculture goals
United kingdom	• Animal health and welfare pathway offers financial support to farmers for improving animal health • Sustainable Farming Incentive (SFI): rewards farmers for implementing practices that support animal welfare and the environment • Veterinary Support and Animal Welfare Reviews: K farmers can receive support for annual veterinary visits to assess animal health, covering areas like biosecurity and welfare • Farm to Fork Strategy
Cyprus	• Animal Welfare Law (Law 46(I)/1994) ensures the protection of animals' health, safety, and well-being, focusing on both domestic and captive animals
Czech republic	• Act on the Protection of Animals Against Cruelty recognizes living beings with inherent value • Aligning with EU legislations
Hungary	• Gradually aligning its farm animal welfare standards with EU directives • Rural Development Program (RDP): to modernize farms, with a focus on animal husbandry and improving the competitiveness of smaller farms • Improving research and innovation
Latvia	• EU Alignment and Support

Inventory and analysis of vision papers concerned with livestock

	• Animal Welfare Investments • Legislation and penalties
Luxembourg	• No strategy was found for farm animals
Lithuania	• Enhance regulatory compliance with EU and national animal welfare laws • Strong focus on ensuring that animal welfare is prioritized at all stages—on the farm, during transport, and at slaughter
Malta	• No strategy was found for farm animals
Romania	• No strategy was found for farm animals

Annex 6. Strategies and goals from the national vision papers: Biodiversity

Country	Agricultural Vision paper
Germany	• Breed Diversity and Biodiversity • Promotion of pasture-based livestock • Extensive and nature-friendly management • Reducing intensive livestock production • Animal welfare improvements • Policy and financial support Cost-covering herd protection measures
Denmark	• Reducing pressures of livestock farming on environmental: reduce GHG emissions, nutrient leakage, ammonia emissions, and pesticide use • Land use changes connected to livestock • Promotion of circular livestock system • More extensive grazing, pasture-based systems • Increase breeding and diverse livestock Shape consumer demands to climate friendly products
Ireland	• Grass based livestock systems remain central • Setting targets for biodiversity on farms: By 2030, Ireland aims for 10% of farmed land to be prioritized for biodiversity • Agri-environmental schemes for livestock farmers • Manage livestock numbers sustainably • Nature-based and regenerative livestock systems Rewarding farmers for ecosystem services
Italy	• Protect and restore genetic resources and natural ecosystems related to agriculture, forestry and aquaculture: 1- Double the agricultural productivity and incomes of small-scale food producers, especially women, indigenous peoples, farm families, pastoralists, and fishers. 2- Maintain the genetic diversity of seeds, crop plants, farm and domestic animals, and related wild species. Promote fair and equitable benefit-sharing from the use of genetic resources.
Netherlands	• Enhancing Ecosystem Diversity: Livestock farming plays a role in creating habitats for various animal species and utilizing biodiversity for essential functions like pollination, soil fertility, and disease resistance. • Integrating nature into farming practices • Preservation of Genetic Diversity • collaboration among farmers, researchers, and policymakers to develop and implement practices that benefit both agriculture and biodiversity
Norway	• Breeding Programs for Sustainable Livestock • Dietary Shifts to Reduce Emissions Voluntary Climate Agreement with the Agricultural Sector: Measures include improving animal feed, breeding practices, and manure management
Switzerland	• Sustainable agricultural practices • Integration of Biodiversity goals Support for research and innovation
Belgium	• Integration of farming with biodiversity and landscape goals • Protected species and habitat conservation • Nature 2000 and agricultural land use including livestock farming • Organic and agro-ecological livestock farming • Reduction of antibiotics and pesticides • Soil fertility and erosion control

Inventory and analysis of vision papers concerned with livestock

Monitoring and outcome targets	
Bulgaria	• National Biodiversity Conservation Strategy • Conservation of Livestock Breeds - Integration of Sustainable Practices in Agriculture
Austria	• Land use change • Sustainable and resource-conserving management • Increasing agriculture adaptation and resilience - Preservation of natural ecosystem
Turkey	• Reducing pressure from habitat fragmentation, pollution and overexploitation - Increasing protected areas and restoring ecosystems
Estonia	• Increasing organic farming - Sustainable and diversified land use shall be supported
Finland	Cooperation between regional development agents will be strengthened to halt biodiversity loss
France	• Develop low carbon innovations using basic and applied research and facilitate their rapid dissemination • Land use optimization • Adaption to climate change, and contributing to green economy • Developing afforestation while concerning ecological implication - Evaluate the implementation of active policies
Greece	• Biodiversity protection and sensitive and protected areas • Increasing production in closed cropping systems to minimize water use and avoid biodiversity problems • Conversion of conventional farming to organic farming methods, participation in ecological management - Conservation and improvement of the environment and biodiversity, and the management of the landscape
Poland	• Extensive sheep grazing for biodiversity conservation • Eco-schemes under CAP to support extensive use of permanent grasslands with livestock to preserve biodiversity • Maintaining pastures and improve nesting for birds through traditional, low-impact grazing - Increasing organic livestock farming
Serbia	• Maintaining animal genetic biodiversity • High nature value farming: Includes traditional, extensive livestock systems like nomadic sheep grazing and pasture-based cattle farming • Sheep grazing and biodiversity • Organic livestock production - Agro-ecological and landscape protection goals
Portugal	• Expansion of biodiverse pastures • Biological and conservation farming • Changes in pasture composition • Improved livestock management - Environmental and biodiversity-oriented agriculture policy
Slovenia	• -
Spain	• Genetic resources preservation • Permanent pasture and grassland increase • Agro-environmental commitments and eco-schemes • Pasture management and landscape features

Inventory and analysis of vision papers concerned with livestock

Monitoring and evaluation	
Sweden	• Growing circular bioeconomy
Preservation of genetic diversity	
Croatia	• Extend the organic and agro ecological farming • Improve the access to irrigation water and efficiency • Improve the access to irrigation water and efficiency • Improve the access to irrigation water and efficiency
United kingdom	• Environmental Land Management scheme
Sustainable Farming Incentive	
Cyprus	• Conservation of livestock breeds • Addressing climate change impact
Sustainable livestock management	
Czech republic	• Subsidies to farmers • Landscape restoration • Protection of natural process • Increase the proportion of landscape features and the number of crops grown • Little fertile arable land should be transferred to other use
Hungary	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Latvia	Management of natural resources
Luxembourg	•
Lithuania	• Improvement of degraded ecosystems • continuous implementation of the biodiversity conservation policy in entire territory
Malta	•
Romania	• Improve and dissemination of Knowledge on biodiversity • conservation, restoration and enhancement of the continuity and connectivity of habitats and ecological networks • Support best practices in agriculture • Support a connected, representative network of protected areas with adaptive management • Integrate ecosystem resilience into all relevant public policies

Annex 7. GHG emission targets of selected countries

Region	Long targeted GHG emission reduction	Year of targeted action	Sub-targeted GHG emission reduction	Year of sub-targeted action
UNFCCC	The EU has set a target for the EU as a whole to be climate-neutral	by 2050	39% reduction of GHG emissions relative to 2005 in nonETS sectors	
Germany	Climate neutrality	by 2050	31 - 34 %	By 2030 v.s. 1990
Finland	80% greenhouse gas reductions	by 2050	Climate neutrality	by 2035
Switzerland		by 2050		
Denmark	The Climate Act's long-term objective of climate neutrality by 2050 at the latest	by 2050	70% reduction of greenhouse gas emissions relative to 1990	by 2030
Spain	Climate neutrality by 2050 (including at least a 90% reduction of greenhouse gas emissions)	by 2050	23%	by 2030 in comparison to 1990
France	Climate neutrality by 2050 with a reduction of greenhouse gas emissions of at least 83.3%	by 2050	.	.
Netherlands	.	by 2050	49% reduction in EU emissions	by 2030 compared to 1990
Belgium	.	by 2050	45% to -51%	2005-2050
Slovenia		by 2050		
Republic of Ireland	Climate neutrality	by 2050	51%	by 2030
Portugal	Climate neutrality	by 2050		
Sweden	Climate neutrality	by 2045	63% by 2030 75% by 2040	.
Hungary	Climate neutrality	by 2050 at the latest	40%	by 2030
Austria	Climate neutrality	by 2040		

Annex 8. Ammonia emission targets of selected countries, 2005-2030

Country	Emission reduction, %
Belgium	13
Denmark	24
Germany	29
Spain	16
France	13
Ireland	5
Italy	16
Netherlands	21
Austria	12
Portugal	15
Finland	20
Sweden	17
United Kingdom	16
EU 28	19

¹ European Commission (2016) [22]